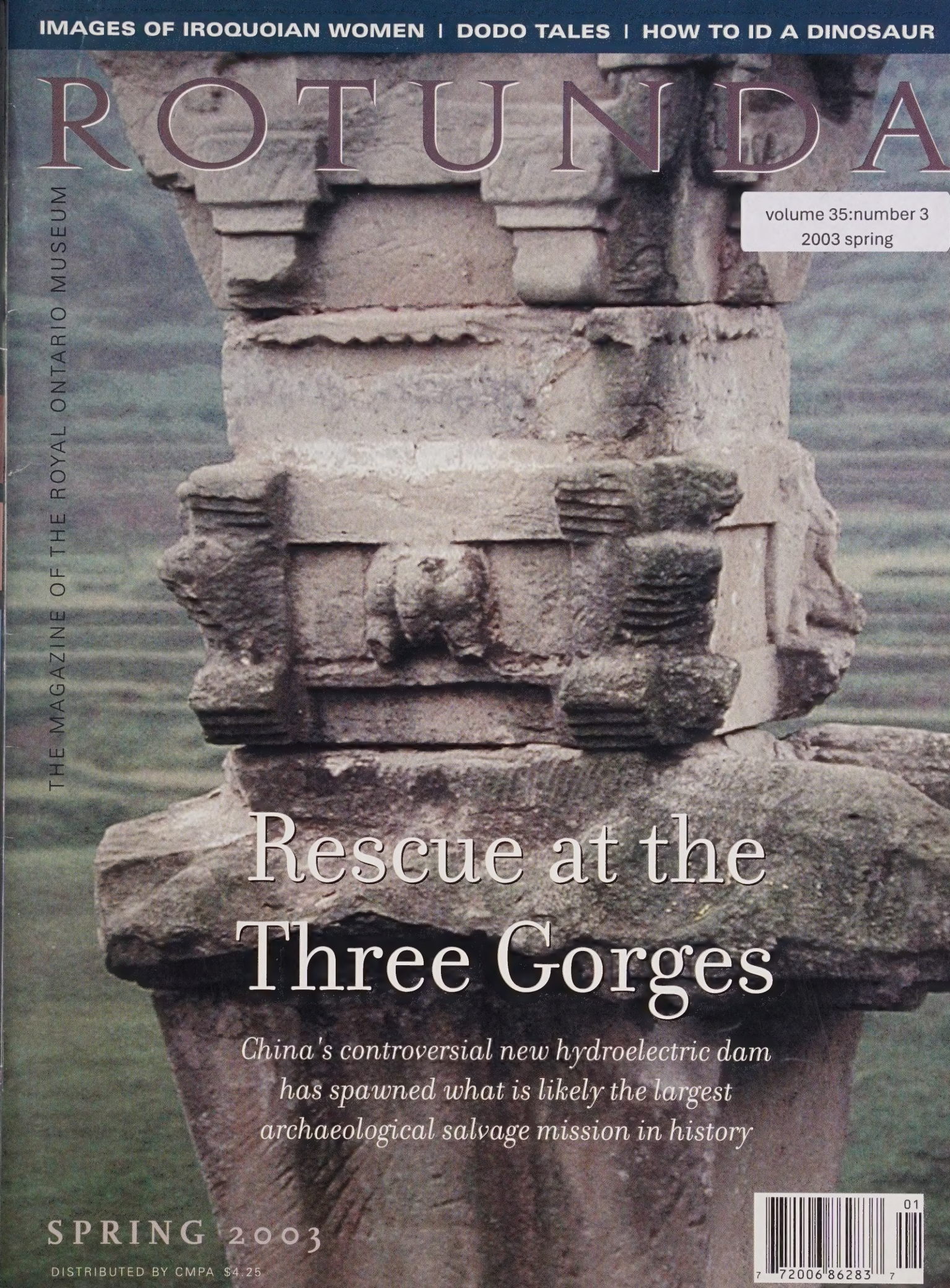
IMAGES OF IROQUOIAN WOMEN | DODO TALES | HOW TO ID A DINOSAUR

ROTUNDA

THE MAGAZINE OF THE ROYAL ONTARIO MUSEUM

volume 35:number 3
2003 spring



Rescue at the Three Gorges

China's controversial new hydroelectric dam has spawned what is likely the largest archaeological salvage mission in history

SPRING 2003

DISTRIBUTED BY CMPA $4.25

01
7 72006 86283 7

Masters Gallery ltd.

"Frood Lake 1939" 38" x 48" oil / board Franklin Carmichael RCA

The art of collecting quality

Masters Gallery Ltd.
815c - 17th Avenue SW Calgary Alberta T2T 0A1 (403) 245-2064
Hours: Tuesday – Saturday 10 AM – 5:30 PM
www.mastersgalleryltd.com

CONTENTS

Volume 35, Number 3, Spring 2003

FEATURES

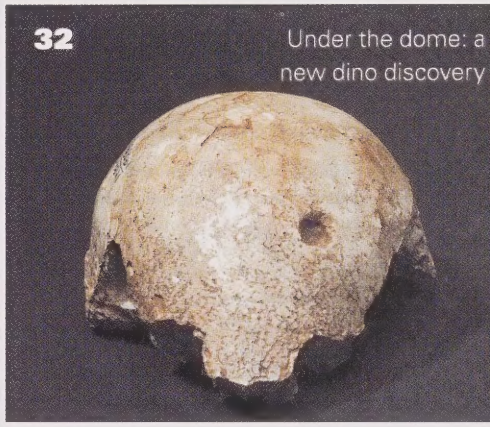
12 **Invisible Women**
In the archaeological record Iroquoian women were almost invisible—or so it seemed until a recent discovery that proves otherwise.
By Mima Kapches

20 **The Great Rescue Project of China**
China's controversial new hydro-electric dam project has spawned what is likely the largest archaeological salvage mission in history.
By Chen Shen

32 **How to ID a Dinosaur**
Two paleontologists unravel clues to the identity of a dinosaur skull, discovering a species never seen before.
By Thomas D. Carr

38 **Ways of the Dodo**
When a mere handful of dodo skeletons existed worldwide, the ROM owned one. Here's how we managed to acquire it—and what researchers have discovered since.
By Kevin Seymour

12 Iroquoian Earth Mother?



32 Under the dome: a new dino discovery

DEPARTMENTS

4 Explorations
Picasso necklace, a tiny pterosaur, sewing for supper, making tracks.

7 Backyard Biodiversity
Lords of the lawn—and other fungal invaders. By Jean-Marc Moncalvo

9 Growing Collections
A former Ottawa mayor's collection of stoneware. By Ross Fox

43 Libris
Book reviews: Edifice and eglantine. By Glen Ellis

45 PaleoScene
Fossilized evidence of life on an ancient seafloor. By Janet Waddington

47 Conservation Notes
The controversial "James" ossuary repaired. By Ewa Dziadowiec

49 ROM Answers
Silverware that helped Canadians keep their cool. By Ross Fox

52 From the Archives
Travelling show and tell. By Julia Matthews

20 Losing horizons in China

THE ROM

PATRONS

The Right Honourable
Adrienne Clarkson,
C.C. C.M.M. C.D.
Governor General of Canada
The Honourable James K. Bartleman
Lieutenant Governor of Ontario

BOARD OF TRUSTEES

Jack Cockwell, *Chair*
Peter Janson, *Vice-chair*

E. M. (Yeti) Agnew, Salvatore Badali,
Andrea M. Bronfman, Lloyd S. D. Fogler,
Robert T. E. Gillespie, Martha Hogarth,
Bronwyn Krog, Sandra Lawrence, Elsie Lo,
Stephens B. Lowden, Bahadur Madhani,
David Mirvish, John F. Prato, Jean M. Read,
Joey Tanenbaum, Richard S. Wernham.

Ex-officio
Robert Birgeneau, Thomas Simpson,
William Thorsell.

ROM FOUNDATION BOARD OF DIRECTORS

James Temerty, *Chairman*

Directors
Jennifer Ivey Bannock, Michael Detlefsen,
John F. Driscoll, Robert Farquharson,
Mark Foote, Gwen Harvey,
Linda Hasenfratz, Michael Lee-Chin,
Hon. Roy MacLaren, James W. McCutcheon,
Dr. Jack Mintz, Robert E. Pierce,
Kim Samuel-Johnson, William Thorsell,
Harriet Walker, Prem Watsa,
Donald A. Wright.
Jack Cockwell, Ex-officio

ROM FOUNDATION BOARD OF GOVERNORS

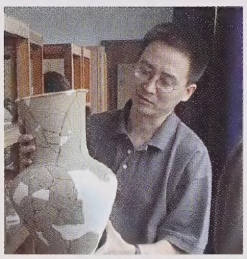
Kenneth W. Harrigan, co-chair
Elizabeth Samuel, co-chair
Bluma Appel, Robert Brown,
Arti Chandaria, Helen Gardiner,
Hon. Edwin A. Goodman, Ned Goodman,
William B. Harris, Hon. Hal Jackman,
Thomas Kierans, Susanne Loewen,
Dixie Anne Montgomery, Bernard Ostry,
Frank Potter, Joan Randall,
Wendy Rebanks, John A. Rhind,
William J. Saunderson, Thomas Savage,
M. Joan Thompson, Lynton Wilson.

SENIOR STAFF

William Thorsell
Director and Chief Executive Officer
Margaret L. Beckel
Chief Operating Officer
Michael Shoreman
Senior Vice-President, Business and Capital Development
David Palmer
President and Executive Director, ROM Foundation

THE ROM'S MISSION IS TO INSPIRE WONDER AND BUILD UNDERSTANDING OF HUMAN CULTURES AND THE NATURAL WORLD.

CONTRIBUTORS



Dr. Chen Shen

Department of Near Eastern and Asian Civilizations

CHEN ("The Great Rescue Project of China") is the ROM's Bishop White Curator of Far Eastern Archaeology. Trained in Wuhan, China, his expertise is in use-wear technique—examination of stone tools under microscopes for evidence of how the tools were made and used. He has led the ROM's fieldwork program in China since 1997.

Thomas D. Carr

Department of Palaeobiology

THOMAS ("How to ID a Dino") is a Ph.D. candidate in the Department of Zoology at the University of Toronto. For his dissertation he is working out the evolutionary relationships and geographic history of tyrannosaurs. Along the way he has described several new species of dinosaur, including tyrannosaurs and dome-heads. The dome-heads are the first of these new discoveries to be published scientifically.

Dr. Kevin Seymour

Department of Palaeobiology

KEVIN ("Ways of the Dodo") is an assistant curator in the ROM's Department of Palaeobiology. Besides overseeing the care of the Museum's vertebrate fossil collection, he conducts research on the evolution of cats as well as Ice Age faunas from Ontario.

Dr. Mima Kapches

Department of Anthropology

MIMA ("Invisible Women") is a senior curator in the Anthropology Department. She is an Ontario archaeologist, specializing in the archaeology of the Greater Toronto Area.

COMING NEXT ISSUE

The Glory of Art Deco

ROM curator Peter Kaellgren looks at the purchasing of Art Deco pieces in Canada—now and when it was new.

DIRECTOR'S MESSAGE

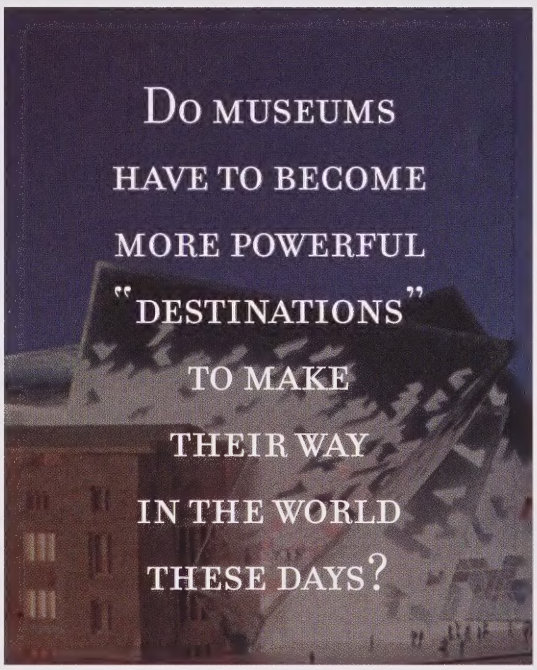
THE CENTRAL PRACTICAL question about the Royal Ontario Museum's expansion plans is this: After the historical restoration, new construction, and additional galleries are finished, will there be enough money to operate it all, much less rebuild the staff resources lost to budget cuts over the past 12 years? This was the core issue in the ROM's 2001 application to Ontario's SuperBuild Fund for $50 million in support of Renaissance ROM. In fact, SuperBuild requires that new capital spending strengthen the economic security and vitality of an institution, rather than expose it to even greater risks.

Everyone has heard stories about capital expansions that generated higher operating costs than could be covered by revenues. Why should we believe the same thing would not happen at the ROM?

The business case for Renaissance ROM is based on careful studies of the market for museum visitors and other sources of museum revenue, such as space rentals, museum shops, restaurants, and licensing. The ROM will never be privatized, but it will certainly need to make much more of its own way in the marketplace if it is to have the means to meet its social missions in public education, collections, research, and pleasure.

At best, government operational support will be flat in real terms in coming years. (The real value of government operating grants to the ROM has fallen from $21.3 million in 1990 to $14.6 million in 2002 – a decline of about one-third.) Our self-generated revenues ($8.9 million last year) need to be established on a much higher base, and be able to grow with the population and economy of Ontario, if the ROM is to remain a museum of first rank. How will Renaissance ROM achieve this, and why should we feel confident in the forecasts?

First, by increased paid attendance. Compared with other major museums in North America, and compared with the ROM's own history in Ontario, the ROM's current attendance is relatively low in relation to its population base and tourist traffic. Indeed, the ROM's "market penetration" of residents and visitors is in the bottom quartile of comparable museums in North America, according to our consultants' studies.



This reflects waning resources over the last 15 years and, to be sure, inconsistent leadership and vision over time. If the ROM's attendance met the average of its peer group in North America, its attendance would grow by 600,000 visitors a year, above the current total of 1 million or so (including students and people who come for free). Meeting this "average" performance goal would generate millions in additional admissions revenue.

Much better physical facilities and marketing would also produce significantly higher revenues through space rentals, retail, and licensing. The ROM's application to SuperBuild demonstrates that, when both phases of the project are complete in 2006, the ROM's self-generated revenue will increase annually by $10.7 million a year. Annual operating costs for the new facilities will grow by $7.4 million a year, leaving significant funds to reinvest in core Museum functions, especially curatorial departments.

Of course, with the combination of historical restoration, Daniel Libeskind's crystal galleries on Bloor Street, excellent new galleries, and other facilities, we expect to do much better than "average" in our marketplaces. On the downside, however, should we fall short of our projections, we can still "break even" in operating our new facilities with smaller increases in paid attendance. The business case for Renaissance ROM is robust.

Do museums have to become more powerful "destinations" to make their way in the world these days? Do they really need to invigorate their architecture (old and new), upgrade their galleries and programs, and offer more satisfying and diverse pleasures to their many constituencies? What's wrong with the quiet status quo?

The status quo restricts the Museum's virtues to a much smaller proportion of the public than the public deserves. And the status quo dooms the Museum itself to chronic retraction in its collections, research, and education functions. Neither is acceptable to the Royal Ontario Museum, or to the people of Ontario, as Renaissance ROM declares.

EXPLORA

M49822 / BRIAN BOYLE, ROM

Picasso Style

Graffiti Art with Glitter

AMPLE SCALE and strong colour characterize the jewellery designs of Paloma Picasso. A stunning necklace—a recent generous donation to the ROM from Tiffany & Co. Canada—designed by Picasso, daughter of the famed Modernist painter, features the splendid use of five boldly coloured gemstones. The setting, in 18K yellow gold, is contemporary, inspired by graffiti art and employing Picasso's classic "X" and "O" design. The stones are citrine, tourmaline varieties verdelite (green) and rubellite (pink/red), aquamarine, and amethyst. Taking its place in the ROM's gem and jewellery collection, this significant piece epitomizes the perennial genius of the jewellery designer's art.

—Katherine Dunnell

ROM 52425 / BRIAN BOYLE, ROM

Winged Marvel

A tiny terrific pterosaur, perfectly preserved

THE ROM IS well known for its collections of dinosaurs and other Mesozoic vertebrates, such as ichthyosaurs, plesiosaurs, champsosaurs, and turtles. But one major Mesozoic vertebrate group is almost entirely unrepresented in the ROM's collections: the pterosaurs, or winged reptiles. Except for a few single bones collected from the Kansas chalk in the 1970s, the ROM's collection consists only of casts. Recently, however, through the generosity of the Louise Hawley Stone Charitable Trust, the ROM has made a start in filling this gap with the purchase of a beautifully complete specimen of one of the smallest pterosaur species known, *Pterodactylus elegans* (which means elegant flight finger). The specimen comes from the famous 150-million-year-old Solnhofen limestone in Bavaria, Germany, which has yielded numerous remarkably complete fossils of vertebrates such as fish and pterosaurs, as well as the rare toothed bird *Archaeopteryx*. Although the ROM's pterosaur is only about 15 cm (not quite 6 inches) long, the elongated snout full of tiny teeth is intact. Fish have been found within the body cavity of a variety of other kinds of pterosaurs, attesting to their last meal; however the stomach contents generally are not preserved in these tiniest of pterosaurs. Because of their size, they would have been able to consume only the most diminutive fishes, and it is thought therefore that they may also have been insect eaters. The pterosaur's elongated fourth finger (prominent on the ROM's new fossil) forms the leading edge of the wing—quite unlike the arrangement of bones in the wings of bats or birds. The new skeleton will be displayed along with a fossil bat and a fossil bird for comparison in the ROM's proposed new palaeobiology galleries.

—Kevin Seymour

TIONS

Sewing for Their Supper

Women's work of choice in the 18th century

In 18th-century France, embroidery was a highly skilled trade regulated by a rigid guild system. Professional embroidery involved the work of a whole team of highly skilled workers. In 1770, embroidery was considered one of the best-paying occupations open to women. The workday lasted from 6 am to 8 pm, with double pay for overtime. The embroiderers had to supply their own needles, thimbles, and scissors. By 1778, Lyon, the centre of the embroidery trade, had 6000 female embroiderers; Paris was a distant second. The trade was not an exclusively female one, and male embroiderers were paid more than women. For men, the rate of pay varied according to their skills, while women received a flat fee. When Rose Bertin, the famed fashion consultant to Marie-Antoinette, fled France in 1793 during the French Revolution, she had six embroiderers in her employ—three men and three women, who may themselves have been heads of individual workshops with many others under their supervision; as a *marchande de modes*, or fashion merchant, she was also permitted to embroider women's garments. In this 1770 engraving of an embroidery workshop (published by Charles Germain de Saint-Aubin), the female embroiderers—one left handed and one right handed—are carefully placed one on each side of the embroidery frame so that their hands will not block the light falling on their work. Several embroiderers could work at one frame, and a contemporary embroidery manual encouraged them to "become accustomed to working with one hand as well as with the other."

—Kimberly Chrisman-Campbell

DAVID RUDKIN, ROM

Clockwise from bottom left: Norm Aime models the latest in tundra heating gear; Brian Iwama monitors the warming and drying of the rock surface; as the tide rises, Norm and Brian quickly apply latex to a trace fossil.

On the Rocks

Paleontologists make tracks in Manitoba

It takes a unique blend of ingenuity, knowledge, and brute strength, coupled with good fortune, to meet the practical challenges of acquiring scientific data in the field. Last summer, these elements were present in just the right mix for a team of paleontologists from the ROM, the Manitoba Museum, and the University of Manitoba. Working along the coast of Hudson Bay near Churchill, Manitoba, the team faced the problem of making high-fidelity replicas of large fossil trilobite tracks, which occur on sloping rock surfaces that are completely submerged at high tide. Even at low tide, when the traces may be exposed for just a few hours, the rock surfaces remain cold, wet, and salt-encrusted. Previous attempts to mould the fossils had produced only mediocre results. But for our 2002 field work, seasoned ROM paleobiology technician Brian Iwama came up with a novel approach. Using a heavy-duty, propane-fired heater and a pre-vulcanized latex paste, Brian (ably assisted by University of Manitoba student Norm Aime) succeeded in moulding two separate tracks, each more than a metre (3.28 feet) long. Even the tides and weather co-operated: we had two days of ideal conditions.

—David Rudkin

STUDY THE CRAFT OF
BOOKBINDING

Home Study Follow our five-course programme in the comfort of your own home. Each course features instructional videos and a manual, as well as the option of critical feedback from experienced bookbinders.

In Studio Take part in our many bookbinding and book arts workshops, each taught by qualified instructors in Toronto and other locations.

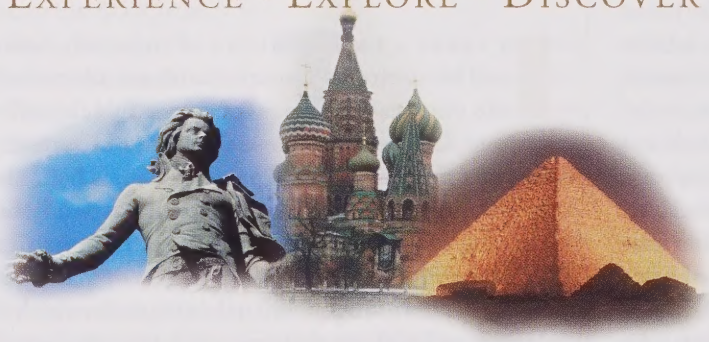
In Your Community Bring CBBAG instructors into your school or community centre.

Visit us at **www.cbbag.ca** for more information or contact our office.

CBBAG

Canadian Bookbinders and Book Artists Guild
176 John Street, Suite 309, Toronto, ON M5T 1X5
T 416.581.1071 F 416.581.1053 E cbbag@web.net
www.cbbag.ca

EXPERIENCE · EXPLORE · DISCOVER



CANADIAN TRAVEL ABROAD has been providing quality educational tours for years. We've opened the doors to Egypt, Iran, Jordan, Greece, Europe, Scandinavia, Russia, Turkey and more. Make 2003/2004 the year that we welcome you to a Canadian Travel Abroad tour.

HIGHLIGHTS OF 2003/2004
FULLY-ESCORTED TOURS
- **Vietnam** – November 2003
- **Iran & Uzbekistan** – May/June 2004 including Teheran, Shiraz, Isfahan, Mashad, Bukhara & Samarkand
- **Bulgaria** – September 2004 Europe's Best Kept Secret!

For more information on our custom-tailored or exclusive package tours, contact: Mr. Himo Mansour
CANADIAN TRAVEL ABROAD LTD.
80 Richmond St. W., Ste. 804, Toronto, ON M5H 2A4
Tel: (416) 364-2738 or 1-800-387-1876
Fax: (416) 364-6951
Email: cantrav@baxter.net
mans2000@on.aibn.com
Website: www.cantrav.ca

ROTUNDA

EXECUTIVE EDITOR
Sandra Piller
EDITOR
Lee-Anne Jack
DESIGN AND PRODUCTION
Peter Enneson Design Inc.
CONSULTING EDITOR
Anna Kohn
COPY EDITOR
Andrea Gallagher Ellis
CONTRIBUTING EDITORS
Mary Burridge
Glen Ellis
Ross Fox
Peter Kaellgren
Julia Matthews
Dan Rahimi
Marianne Webb

ADVERTISING SALES
Colin Hennigar
(416) 586-5546

EDITORIAL AND MARKETING OFFICES
Rotunda, the magazine of the Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, or telephone (416) 586-5585, e-mail lee-anne@rom.on.ca
ROM Web site: www.rom.on.ca

Published three times per year by the Royal Ontario Museum. © The Royal Ontario Museum, 2003. Printed and bound in Canada. Indexed in the Canadian Periodical Index and the Canadian Magazine Index and available on-line in the Canadian Business & Current Affairs Database ISSN 0035-8495. Canadian Publications Agreement # 40068986.

SUBSCRIPTIONS & SINGLE COPY SALES
Subscriptions cost $12.84 (3 issues) including GST, outside Canada add $6 for postage and handling; single copies cost $4.55 including GST. All circulation and subscription inquiries should be addressed to *Rotunda*, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6. Phone: (416) 586-5546, Fax: (416) 586-5649

THE ROM GRATEFULLY ACKNOWLEDGES THE LOUISE HAWLEY STONE CHARITABLE TRUST FOR ITS GENEROUS SUPPORT OF THIS PUBLICATION

Lords of the Lawn

Fungal invaders can lurk invisibly underground and in the air before exploding from your well-manicured lawn.

JEAN-MARC MONCALVO

THE TYPICAL North American backyard and man-made recreation park are the antithesis of biological diversity—they tend to be monocultures of turf grass, adorned with a limited number of well-spaced ornamental species of shrubs and flowers. To further annihilate diversity, many of us dump tons of fertilizers and pesticides on our lawns every year to eradicate organisms that, for one reason or another, have been declared annoying and unwanted. But life is resilient: we all know that crab grass and dandelions survive, even in perfectly manicured golf courses. And did you notice that fungus in your lawn?

Despite our efforts to prevent turf grass invaders, there are at least two dozen common species of macrofungi—otherwise known as mushrooms—that one morning can suddenly pop out in our Canadian lawns. Most of them are well documented in a recent book by G. Barron called *Mushrooms of Ontario and Eastern Canada*, (1999, Lone Pine Publishing, Edmonton, Alberta). For a mycologist, these mushrooms are intriguing; they are the majestic lords of the lawn. Feeding on decaying organic matter buried in the ground, they play a significant role in the recycling of carbon, that very essential molecule in the development of life on Earth.

But they have other charms as well. Several lawn mushrooms make excellent eating, such as the shaggy mane (*Coprinus comatus*), the fairy ring fungus (*Marasmius oreades*), the sidewalk mushroom (*Agaricus bitorquis*), the meadow mushroom (*Agaricus campestris*), and the giant puffball (*Calvatia gigantea*)—the latter three of which are closely related to the widely commercially cultivated button mushroom (*Agaricus bisporus*). Another good, edible mushroom is the smooth *Lepiota* (*Leucoagaricus naucina*), although this species can be easily confused with the infamous deadly poisonous destroying angel (*Amanita virosa*). Nutritionally, mushrooms contain more protein than vegetables and fruits, have high vitamin content, are low in calories and cholesterol, and are also good sources of essential minerals, such as calcium and phosphorous.

A few species of common fungi were historically or are still used to cure or prevent various illnesses. The widespread artist fungus (*Ganoderma applanatum*), for instance, is part of the traditional Chinese pharmacopoeia, and has also been used by the Nitinaht Indians of Vancouver Island; the shelf fungus (*Phellinus igniarius*) was used as a laxative by the Inuktitut; and the Birch Polypore (*Piptoporus betulinus*) was

JEAN-MARC MONCALVO, ROM

COURTESY DR. G. BARRON

COURTESY DR. G. BARRON

COURTESY DR. DAVID PORTER

Top Left: Turf grass spotted with rust fungi. **Right:** The lawn mushroom Shaggy Mane (*Coprinus comatus*). **Bottom left:** *Conocybe lactea*, a pretty lawn fungus. **Bottom centre:** The common mold *Aspergillus fumigatus* seen under a microscope.

glass

toronto's
hip new bar

international
cuisine

signature
cocktails

fridays
6:00 – 11:00 pm

ROYAL ONTARIO MUSEUM

Bloor St. W. at Avenue Rd.
416.586.8000
www.rom.on.ca

EAT DRINK LOUNGE

found in a bag carried by the 5300-year-old Ice Man, whose frozen body was discovered in 1991 in a glacier in the Alps at the border of Austria and Italy. This fungus was presumably being transported for either a medicinal or shamanic purpose.

When you spot a macrofungus in your lawn, what you see is only the ephemeral reproductive structure of an organism that lives permanently underground in the form of a loose, branching network of strings invisible to the naked eye, called hyphae or mycelium. Most fungi form tiny, much more inconspicuous, reproductive structures, such as rust fungi and molds that can tint the leaves of your grass and ornamental plants red, black, or white.

Many fungi spend their entire life cycle below ground; for instance, the group of fungi called arbuscular mycorrhizae colonizes the roots of 80 percent of land plants, including all turf grasses. Mycorrhizal associations provide several benefits to a plant—the fungus facilitates the transfer of nutrients from soil to plant and can improve the speed at which a lawn is established, the drought resistance of the turf (thus saving costs in water and fertilizer), the rooting depth of the grass, and the prevention of disease. Golf-course managers are beginning to make use of these fungi to decrease unwanted plant diversity.

Microbiologists have calculated that a gram of soil contains hundreds of thousands of microorganisms, among which bacteria and fungi mainly dominate. Thus, even soil in a backyard sorely lacking in biological diversity is likely to harbour several hundreds, if not thousands, of fungal species. If you look closely, you are likely to find carnivorous and insectivorous fungi in your backyard. Some attack and kill flies and other insects, while others trap and kill soil nematodes and other worms. If you let these animals thrive and multiply in your backyard, the fungal diversity in your property is also likely to increase. I should also mention that if you don't carefully remove rotting stumps from your backyard, or if you store fire logs outside, you may well receive a visit from Jack O'Lantern (*Omphalotus olearius*), a fancy mushroom that discreetly glows in the dark.

Some fungi are annoying, such as the turf-destroying *Ustilago* smuts and pink or gray snow molds. (Snow molds can be found on grasses and cereals in many areas of Canada and elsewhere with persistent snow cover.) Others can produce allergic reactions.

In its lifetime, a fungus produces billions of airborne spores to facilitate its dispersal. In fact, fungi produce so many spores that we are continually exposed to them in outdoor as well as indoor environments. It has been calculated that one cubic metre of air can contain as many as 10,000 fungal spores. Spores belonging to the fungal genera *Aspergillus* and *Penicillium* (from which the first antibiotic, penicillin, was discovered) are commonly found in the air.

Inhaling spores of *Aspergillus fumigatus* can cause allergies for some, and may pose severe problems for people with compromised immune systems, such as AIDS patients. This fungus is common in soil, moldy grains, straw and hay, bark, and woodchips, and it has been suggested that for home-owners, mowing the lawn is the most common source of exposure to *A. fumigatus*.

Because fungi are cryptic, their diversity and roles in ecosystem functions are still not well known. An estimated 1.5 to 3 million species exist worldwide and about only 10 percent of this diversity is described, making fungi one of the most diverse and understudied groups of organisms. Their very ancient origin and their success in diversifying and in colonizing every possible habitat helped to make the planet suitable for human life, and these lords of the lawn will continue to thrive on Earth long after humankind has vanished.

Jean-Marc Moncalvo is curator of fungi in the ROM's Centre for Biodiversity and Conservation Biology.

Early Canadian Stoneware

The highly personal collection of a former mayor of Ottawa reveals his intense dedication to preserving Canada's material heritage.

2002.93.56, 2002.93.2, 2002.93.22 / BRIAN BOYLE, ROM

From left to right: 3-gallon crock by Flack & Van Arsdale of Cornwall, Ontario; 5-gallon jug by Orrin L. Ballad of Saint Johns, Canada East; 2-gallon jug by unidentified potter.

MASTERLY INSIGHT and absolute devotion were the forces that shaped a remarkable collection of early Canadian stoneware given recently to the Royal Ontario Museum in memory of Lorry Greenberg by his wife, Carol. This matchless collection, which Greenberg assembled over a period of 20 years, was a special source of pride to him. It adds considerably to the ROM's already rich holdings of Canadian pottery.

Lorry (Lawrence) Greenberg (1933–1999) exemplified extraordinary public achievement and personal self-fulfillment: he was a successful businessman, a social activist, a politician, and an antique dealer. With his three brothers, Greenberg founded Minto Construction, which for many years has been one of Canada's largest home builders. In 1961, he retired from business and for the next 12 years involved himself full-time with volunteer social work, above all with troubled youth. He was also attracted to politics and became, successively, alderman, city controller, and then mayor of Ottawa from 1974 to 1978. But because of compelling health considerations, at just 45 years of age he chose to retire from public life.

ROSS FOX

It was then that Greenberg turned to collecting Canadian antiques—a manifestation of his desire to better under-

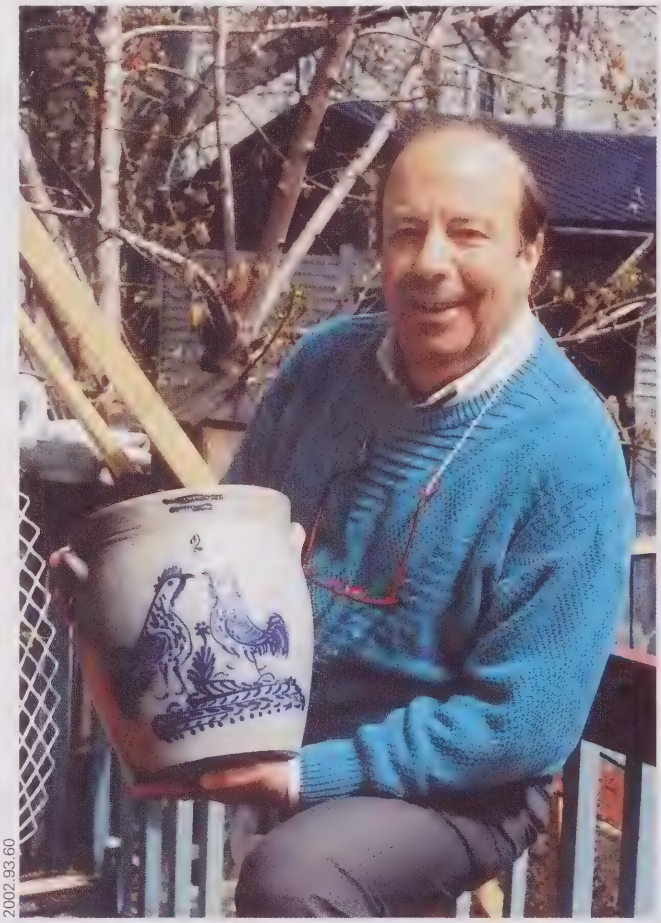
stand Canada, its history, and what it means to be Canadian. Early Canadian stoneware became his passion.

A superior form of earthenware, stoneware was not made in Canada until 1840. It was introduced, belatedly, as an extension of developments in the United States. Most of the first Canadian stoneware potters were American immigrants. The raw material also came from south of the border—stoneware requires a special clay with high silica content, which had to be imported from New Jersey, and later from Ohio as well. Even the coal to fuel the kilns and achieve the high temperatures needed for firing stoneware was imported. Because of this dependency for raw materials and know-how on sources to the south, it is hardly surprising that the pottery techniques, forms, and decoration of early Canadian stoneware accord with American stoneware of the same period.

Though the material was remarkably suited for fine wares, stoneware production in Canada, as was largely the case in the US, was limited to coarse wares of somewhat prosaic character—mainly container wares for the transportation, storage, and preparation of food and various staple goods. The material's hardness and durability when fired made it highly suitable for utilitarian vessels, such as crocks and jugs, which were subject to heavy-duty use over extended periods of time.

Canadian stoneware was most popular from the 1850s through the late 1880s, after which production began to decline. By the 1910s, it had all but disappeared. Gradually, stoneware vessels were supplanted by other means of food preservation, such as glass preserve jars, metal cans, and refrigeration.

Lorry Greenberg preferred decorated stoneware first and foremost. Of the 69 pieces in his collection, most are crocks and jugs, complemented by several other forms, especially preserve jars. But decoration aside, Greenberg's selection appears to have been guided by a number of other intersecting criteria. Above all, he sought to document the history of stoneware production in eastern Ontario and its two main sites, Picton and Cornwall. Another part of his collection is stoneware from Saint Johns (Saint-Jean-sur-Richelieu), Quebec, which was the top-ranking production centre in Canada. And because of his personal affinity with Ottawa, he also focused on vessels made for the Ottawa market. As most of these vessels do not have makers' marks, the precise potteries from which they originate are a matter of conjecture. Many, no doubt, came from eastern Ontario or Saint Johns. A fourth, though smaller, category consists of vessels from central Ontario.


2002.93.60

The late Lorry Greenberg holding a prize crock by S. Skinner & Co. of Picton, Canada West.

As a whole, the collection is remarkably inclusive in its chronological development and representation. Greenberg strove to represent a broad cross-section of key potters. This systematic outlook is also evident in the relative numbers of vessels in various sizes. In keeping with their utilitarian function, the size of crocks and jugs can be graded based on the gallon measure: 1-gallon, 2-gallon, 3-gallon, and so on. Comparable numbers for items of each size in the Greenberg collection imparts a quasi-taxonomical character to it. And duplication was avoided at all costs. No two crocks or jugs of identical size are by the same potter, with a single exception. This underlying diversity offsets an otherwise apparent sameness to the collection as a whole.

Greenberg's endeavour to document was tempered by his insistence on quality. He sought the finest examples in the best possible condition. Altogether his method of acquisition embraced knowledge, resolve, and patience. A consequence of this high degree of focus and coherence—although not planned with this final destination in mind—is a collection that meshes felicitously with the ROM's existing holdings of early Canadian stoneware, which best represent the output of central Ontario.

Some particularly rare pieces affirm the thoroughness of Greenberg's efforts to trace the history of Canadian stoneware. One such example is a jar by Moses Farrar, who is credited with founding the first stoneware pottery at Saint Johns in 1840/41. Born in Montreal, he trained as a potter in Vermont. Farrar was the surname of a well-

known, extended family of Vermont potters, to which Moses belonged. The jar by Farrar is impressed "ST JOHNS LC"; the "LC" suggests that the jar must date from Farrar's first year in Canada because in 1841 Lower Canada became known as Canada East (modern-day Quebec). A decade later, Eben L. and George Whitfield Farrar moved to Saint Johns, where they also made stoneware. Eben and Moses were in partnership c. 1854–1855, and Eben and George were in partnership c. 1857–1858. These potteries are represented in the Greenberg Collection, as are succeeding enterprises of the Farrars and other potters at Saint Johns.

Another early jug is impressed "E. LESLIE AND SONS / DRUGGISTS / TORONTO / U.C." In this case the initials UC stand for Upper Canada, again indicating a date of 1841 (the year Upper Canada became known as Canada West) or earlier. The ovoid shape of the body also betrays an early date and is rarely found in Canadian stoneware jugs, which usually have an essentially cylindrical body with sloping shoulders. In all likelihood this jug was made in the United States. Because the letters were impressed with the merchant's name before firing, it would have been a special-order vessel.

Another 4-gallon jug sans potter's name and made for James A. Queen of Quebec City is painted with a deer and a tree. This unusual motif has striking parallels in the decoration of the Norton potteries of Bennington, Vermont, suggesting either that it was made there, or that it was made by a potter who had worked there before coming to Canada. In these and other early examples, the inter-connections of Canadian and American stoneware are patent.

The origins and progress of this industry in the Canadian context are exemplified best in three vessels in the Greenberg Collection by Orrin (also Oren) L. Ballard. The earliest is a preserve jar made by the partnership of Orrin L. and Alfred K. Ballard in Burlington, Vermont. The Ballard

2002.93.57 / BRIAN BOYLE, ROM

This 3-gallon crock is by W. E. Welding of Brantford, Ontario.

brothers actually started stoneware potteries in Gardiner (c. 1854–1855) and Portland (1855–1856), Maine, before re-locating to Burlington in 1856. A 5-gallon jug by O. L. Ballard was made in Saint Johns, Canada East, where Ballard settled briefly in 1857–1858 (see page 9). Still another 2-gallon jug was made in Cornwall, Ontario, where Ballard operated the first stoneware pottery, which lasted from about 1864 to 1869. These vessels testify to the mobility of potters and the short life of many potteries. Comparable developmental patterns can be traced through other vessels within the Greenberg Collection.

As thoroughly as this collection elucidates the history of early stoneware in Canada, the principal attraction of the stoneware resides in the "art" rather than the documentation factor. Despite its mundane function, a great deal of Canadian stoneware has a fetching aesthetic appeal in its decoration, which traverses the realm of folk art. This decoration, consisting of elementary but poignant images, is often splendidly conceived. Generalized floral or animal motifs are most common. They were painted sparingly in a blue glaze by the untutored hands of workmen. Stoneware's durability has contributed in no small part to its importance as Canadian folk art. So much early folk art has perished because of the fragility of the materials with which it was made. By comparison, decorated crocks and jugs such as those in the Greenberg Collection have an almost limitless potential to survive.

Many pieces in the Greenberg Collection are truly fine examples of folk art. Two of the most exceptional items were made by S. Skinner & Co., active in Picton, Canada West, from 1855 to 1867. One is a 2-gallon crock painted with a heraldic-like double-chicken motif (see page 10), the other is a 4-gallon jug decorated with a rooster and flower.

Specimens that are at once exceptional and typical within this highly focused area of ceramic material history are what make the Lorry Greenberg Collection an inestimable cultural treasure. This gift is a significant enhancement to the early Canadian stoneware already at the ROM.

Dr. Ross Fox is associate curator of Canadian historical decorative arts in the ROM's Department of Western Art and Culture.

885.2.1 / BRIAN BOYLE, ROM

HD8647

Invisible

RECENTLY, AS I EXAMINED a collection of stone effigy pipes in the ROM's collection room for all archaeological artifacts from the Americas, I made a startling discovery. The stone pipes with a detachable wooden stem—called calumets—were in a drawer at eye-level; instead of looking down at them as I normally would, I was looking at them head-on, my nose at the edge of the drawer. At this angle, I could see that one of the effigies was looking back at me—or at least an image with two eyes and ears was looking at me, peering up from the bottom of the pipe. What surprised me most was that, on closer inspection, the stone figure appeared to be that of a woman, and the startled face looking back at me was that of a newborn.

If history and archaeology offered a more complete picture of Iroquoian women's lives, this image would not have been surprising at all. But reading the accounts of early French missionaries and explorers, one is hard-pressed to recognize Iroquoian women as the backbone of their society. Yet women were, and continue to be, vitally important in Iroquoian culture.

We know, from the occasional comment in historical accounts and from the archaeological record, that at least from the time of European contact—in 1615—Iroquoian women played key social roles. Iroquoians were matrilineal, with descent tracing through the mother's family,

In everyday life and in mythology, Iroquoian women played a vital role. But in the archaeological record they were almost invisible—or so it seemed until a recent discovery proved otherwise.

NS89

By Mima Kapches

Women

not the father's. Women owned longhouses, which they shared with their daughters, their sisters, and their families, so they were also matrilocal—meaning that when a man married, he moved into his wife's home. Women worked together in the fields to plant and harvest corn, beans, and squash, the mainstays of Iroquoian subsistence. As well, women were influential in the politics of the community. Although they could not speak directly at council meetings, they made their opinions known through male intermediaries, who spoke on their behalf.

In mythology, too, women played a key role. For Iroquoians, the most significant story is that of creation. In this story, one woman, Aataentsic, was the first woman and the mother of humankind. She gave birth to twin boys—Iouskeha, who was good, and Tawiscaron, who was wicked—who formed the Earth and gave rise to humans and animals. Through the twins' birth Aataentsic became the embodiment of the Earth Mother. The fertility of women through childbirth, and of the land through the tending and harvesting of crops, became intertwined in Iroquoian and other pan-American mythologies.

In written documents, however, women are present mainly in the shadows. Early first-hand observers—the religious and political emissaries—were men, and so may not have been closely involved in observing women's activities. Perhaps this is why we end up with historical accounts that incorrectly place Native women on the periphery.

The pipe Mima Kapches found in the ROM's collections is one of a few that have recently been discovered to be carved with stylized images of women, depicting childbirth and pregnancy. This pipe may portray the birth of twins Iouskeha and Tawiscaron of Iroquoian legend. Right: One face can be seen peering up from the bottom of the pipe. Top: Two eyes for the second face can be seen. Bottom: The squatting effigy with a basket on her back.

It's a similar story with the archaeological record. While the artifacts of women's lives are varied and many—from the ceramic pottery vessels they made and the bone and stone tools they used for making clothes, to the baskets and mats they wove and the antler combs and beads they wore for adornment—images of the women themselves are scarce. While human images in general are uncommon in Iroquoia, those that can be interpreted as representing women are so rare as to be almost non-existent. In a 1979 study of nearly 800 Ontario Iroquoian effigy pipes, for example, not one was identified as representing a woman.

The pipe I found is one of a few in the ROM's collections that have recently been discovered to be carved with stylized images of women, depicting childbirth and pregnancy; these few pipes may portray female roles in Iroquoian mythology as well as aspects of Iroquoian women's real lives.

The effigy pipes made by local Iroquoian peoples—the Neutral, the Petun, and the Huron—from about 1500 to 1652 are one of the most intriguing archaeological artifact types from Ontario. The pipes are unparalleled in the Americas for their artistry. Father Gabriel Sagard observed in an account of his 1623–1624 mission, *Long Journey to the Country of the Hurons*: "They are fond of painting, and practise it with considerable skill . . . they make pictures of men, animals, and birds and other things in caricature, both in perspective on stones, wood, and other similar substances . . . [and] as an ornament for their calumets and pipes."

1891 clay pipe from York County described in the *Annual Archaeological Report for Ontario.*

From such historical accounts we know that Iroquoian men made and smoked pipes, growing the tobacco in plots in the village. There is no documentary evidence that women did so. Pipe-smoking was both a secular and a sacred activity. On long canoe trips, when there was little time to stop and eat, smoking dulled hunger pangs. But by far the most frequently cited episodes of pipe-smoking are in the context of rituals. There are many varieties of recorded Iroquoian rituals: religious, political, seasonal, and medicinal. Pipes could have meaning in several ritual spheres, and some likely had very specific powers when employed by shamans.

The challenge with studying effigy pipes lies in looking for stylistic patterns, which might reveal iconography and possible usage. For years, anthropologists have speculated on what the images on the effigy pipes meant for the Ontario Iroquoians.

Until research on the ROM's collections by Glenn Kearsley postulated that a specific "hunched-back" and "pinched-face" clay pipe represented a real person, a physically deformed Huron Iroquoian shaman named *Tonneraouanont*, ("Healing Smoke," *Rotunda*, Summer 1998), researchers thought that the pipes portrayed mythical beings, either human or animal, or beings that combined both. Could the pipes reflect actual events in Iroquoian life? It is not inconceivable. Certainly the pipes studied by Kearsley had both religious and political import. The question is: How exactly would the effigy pipes have been used, and by whom?

When I picked the pipe up out of the drawer that first day, I saw that the main image was a human effigy made of stone, very well executed, in a "hear-no-evil" posture—squatting, with its hands placed firmly over its ears. The unexpected second effigy was emerging from beneath the first one's carefully carved feet, in front of a well-defined derrière. The eyes and ears suggested an animal of some sort, but a closer look revealed that the "eyes" were the two ends of a drilled channel for a leather thong for suspending the pipe. But below this figure, on the pipe's footrest, were two more eyes—a third image!

Having given birth to two children, I immediately recognized this posture. It was one I remember, not too fondly, from pushing a baby head-first out of the womb. It certainly looked like a birth event, a birth of not one but two beings—one human, the other not. Intrigued, I began to examine other pipes in the collections. One clay pipe had similar imagery suggestive of child-birth. Yet another stone pipe, in a similar pose, seemed to have markings suggesting female genitalia.

In northeastern North America, images of women, real or symbolic, are not common on artifacts. When a human image appears on an Iroquoian pipe, it is usually described as being male, no matter what the indicators. As Sagard succinctly wrote, "they made images of men." Archaeologist Larissa Thomas has recently argued that in some cases, figures are regarded as male even when they have definite female attributes, such as breasts and female genitalia. In cases where female sexual characteristics are obvious, Thomas argues, the predominantly male researchers have been biased in their identifications of the figures as male. I am not convinced that researcher bias is the sole explanation.

There is a deeper anthropological reasoning for these assumptions. As important as women were in Iroquoian and other North American societies, they traditionally were not shamans, healers, or leaders—those roles were the purview of men. And it is men who seem to be main-

Right: The scored line seen between the legs on this effigy indicates female genitalia.
Top: The feet can be seen tucked up in a squatting position.
Bottom: The basket on the back is typical of women.

ly portrayed on artifacts, men who had assumed these roles. As well, in many societies, shamans were often costumed while conducting rituals—dressing as a woman may therefore have been part of some rites. In the 17th century, shamans would stuff their shirts with straw to portray pregnant women during specific curing rituals among the Huron. Further complicating matters is that while gender is obvious in some depictions, in others it is unclear, more abstract.

The calumet that first caught my attention was from the Normal School collections, the teachers' college of the day, which had its own museum. The collection was donated to the Royal Ontario Museum of Archaeology in 1933. The pipe was found south of Penetanguishene in Simcoe county, the homeland of the Huron Iroquoians. Donated by Mr. A. C. Osborne, the pipe, which dates between 1620 and 1650, is 79 mm (just over 3 inches) tall, fashioned of a soft stone mottled grey to light brown in colour. The hands have four fingers each—no thumbs. The face has a protuberant nose, a straight line for the lips, and two eyes, and the figure sports a flat round cap. The well-formed feet have four toes each and are "pigeon-toed." Because the pipe bowl is on the effigy's back, the smoker would have faced the effigy while smoking.

As important as women were in Iroquoian and other North American societies, they traditionally were not shamans, healers, or leaders—those roles were the purview of men

There is nothing obvious about this figure to suggest that it represents a woman. Because it is crouching, no secondary sexual characteristics, such as breasts, are visible. Only the location of the upward-looking head at the feet leads me to postulate that this is a female figure experiencing childbirth.

A second calumet (also from the Normal School collection) is from Brant County, donated by Mr. A. G. Smith. Likely of Neutral Iroquoian affiliation and dating between 1620 and 1652, it is made of a butterscotch-coloured soft stone and stands 67 mm (2.68 inches) tall. One of the features of this pipe, which immediately sets it apart from the first one, is that the effigy looks away from the smoker. The face is worn smooth, but two eyes, an elongated nose, and a line for the mouth are visible.

There is a line incised down the centre of the head, and the back of the head is bulbous, in two lobes. Could this be the well-worn remains of a centre part with the hair formed into two buns? There is a slight line at the base of the skull, which might be the well-worn remnant of a cap. The effigy appears to be squatting, and between the legs there is a very definite gouged groove. Like the other image, there is nothing obvious about this one to indicate that it is a female. However, a scored line between the legs is usually interpreted as symbolizing female genitalia.

A third pipe from the ROM's collection is a stemmed pipe made of clay. It is an Iroquoian pipe from southern Ontario and probably dates around or after 1300 AD. It is 59 mm (2.36 inches) high. The face has broken off but enough remains to see that the image faced the smoker and that the hands cover a protruding abdomen, suggesting pregnancy.

These three pipes have certain features in common: all figures have arms akimbo and legs bent into a squatting stance, and the pipe bowls are on the backs of the figures. All three have attributes suggesting they are women.

I wondered, then, if there might be other pipes from Ontario that depict women, which simply haven't been recognized. In 1891 a clay pipe from York County was described in the *Annual Archaeological Report for Ontario*. It has two hands, with splayed fingers, placed over the chest, suggestive of hands covering breasts. The bent legs are visible in the etching. The effigy head has broken off, but it would have faced the smoker. The figure was not identified as female in the 1891 report. There are two clay smoking pipes from the Neutral of southwestern Ontario with figures that have pronounced breasts, emphasized by lines radiating from the nipples. One of these pipes is in the collections of the University of Toronto at Mississauga, where it is affectionately called "Madonna," an allusion to the well-known rock star's similar Valkyrie-like bustier. This pipe also has darkened areolae, which indicate that a woman is pregnant or has borne children. The other complete pipe is in the Canadian Museum of Civilization; it is of particular interest because the effigy is a pinched face thought to represent the Huron hunched-back sorcerer. But since this sorcerer was a man, why would he be shown as a woman? Could this be an example of a masquerade?

Perhaps the earliest effigy in eastern North America to represent a woman is from near the site of Cahokia in St. Louis, Missouri, and the elements of this figure may give us some insight into the ROM pipes. Called the Birger figurine, it dates to about AD 1050–1150 and is made of bauxite, but it is not a smoking pipe. Smoking pipes, dating from between 900 and 1500, which had similar attributes, are found in eastern North America. These female depictions are not common; only 13 figurines and three stone smoking pipes are reported from the Mississippi region.

In a 1986 article in *American Antiquity*, archaeologist Guy Prentice documents the attributes of these figurines, which he argues represent the Earth Mother. The

Top and Bottom: Hands holding an extended belly is a common pose for a pregnant woman. Middle: Feet that are tucked under are typical of these pipes.

ROM's effigy pipes have some of these attributes, including bent knees, arms akimbo, and a basket on the back (represented by the pipe bowl). Differences are that the Birger figurine has definite breasts and a tumpline showing how the basket was supported by the head while being carried, and there are images of corn, squash, and a serpent (serpents indicate fertility). The Birger figurine is interpreted as the consummate figure of fertility, a goddess of childbirth, an Earth Mother.

The success of the harvest and the fertility of the land were of paramount importance to the horticultural peoples of eastern North America, as of course, was the fertility of women. Anthropologists think that images combining women and the harvesting of plants represent the Earth Mother. Old-Woman Aataentsic, the mother of creation in Iroquoian myth, is often portrayed with a basket on her back. The co-incidence of other elements of the pipes—arms and legs bent, in the act of giving birth, and scored lines representative of female genitalia—suggests that the effigy figures symbolize the Iroquoian Old-Woman, known elsewhere in the northeast as Earth Mother. The presence of two secondary images on the first stone pipe I noticed in the ROM's collection could reflect the birth of the sons, the twins of Iroquoian mythology, Iouskeha and Tawiscaron. Since the one image has pointed ears, however, it could represent an animal, such as a dog or a bear, though no one knows why an animal would be represented.

Why would these images appear on smoking pipes? On a most obvious level, they may relate to shamanistic assistance during childbirth. While having a child was not considered an illness that needed curing and would therefore not routinely require a shaman, birthing was the most traumatic and dangerous episode of a woman's life. It was dangerous for both the mother and the child, since death was a well-known outcome. The French explorers and missionaries may not have been well acquainted with childbirth, but growing up at a time when at-home birthing attended by midwives was the common practice, they would not have been ignorant of the process. Father Gabriel Sagard observed among the Huron that "the women with child are so strong that they give birth by themselves, and for the most part do not lie up." He adds that they come in from the woods with firewood, give birth and "immediately they are on their feet at their ordinary employment." While birthing was for the most part handled by the women of the community, it is possible that the Ontario pipes were made by shamans to call for spiritual help during the birth process.

Although Iroquoian women are not recorded as having been pipe smokers, almost certainly they needed shamanistic assistance during specific times in their lives, and childbirth was one of those times

Although Iroquoian women are not recorded as having been pipe smokers, almost certainly on occasion they needed shamanistic assistance during specific times in their lives, and childbirth was one of those times. Even in a modern hospital, giving birth is a traumatic experience. When giving birth in a wooden longhouse surrounded by midwives, a shaman's presence with a special ritual pipe would have been a comfort to the new mother, although it is unlikely that anyone but the shaman would have been smoking. The clay pipe could have been used to ensure a healthy pregnancy.

The pipe with breasts and the pipe with hands over the breasts also obviously represent women or men dressed as women, though archaeologists haven't unravelled why women would be depicted in a context outside childbirth. It's possible that these images are related to the fact that by the 17th century, the Iroquoian peoples of Ontario faced incredible new stressors in their lives. Not surprisingly, shamanistic activities greatly increased in response to these changes. Images on smoking pipes had appeared during earlier times, but had been limited in their variety. After Europeans appeared around 1615 AD, the images became more varied. Few meanings are offered for these images.

It is possible that the role of Aatentsic increased in significance, since she reinforced fertility at a time when European diseases, such as smallpox, caused an overwhelming number of deaths, devastating Iroquoian communities. Still, the Earth Mother imagery itself pre-dates the arrival of Europeans; the concept was already widespread throughout the Americas. But at a time of terrible stress, the symbolism of the Earth Mother became perhaps singularly important to Iroquoians. This image signified birth and fertility of both the people and the land at a time when the old Iroquoian ways were being dramatically challenged.

That women on artifacts such as smoking pipes have gone unrecognized is probably due to the very limited numbers of such images, and just possibly to male-observer bias. Although still enigmatic, these few discovered images make the seemingly shadowy existence of Iroquoian women more tangible. The rare images of women, pregnancy, and birth depicted on these pipes pose many questions, many more than can be answered. Despite this, they represent a precious record of the day-to-day life and mythological roles of Iroquoian women. Through these images we can glimpse—and imagine—the honoured and pivotal position held by women in Iroquoian life. ■

三峡 The Great Rescue Project of China

By Chen Shen

By 2009, some 21 cities and counties will be submerged by China's giant new hydro-electric dam. The controversial project has spawned what is likely the largest archaeological salvage mission in history.

Last fall, I was conducting archaeological fieldwork in northern China when, a few days after China's National-Day holiday on October 1, almost all the archaeologists I know suddenly packed their gear and left. The mass exodus made sense when I discovered that these specialists were headed for the Three Gorges to begin another session of what is probably the largest archaeological salvage project in history.

By 2009, the Three Gorges area in the middle Yangtze River straddling the western part of Hubei province and Chongqing municipality will be inundated by flooding from a giant hydroelectric dam that is currently under construction. The dam will form a channel-type reservoir 660-kilometres (410 miles)

CHEN SHEN, ROM

The dam in progress. Top: Map showing the area that will be flooded by the Three Gorges Dam. **Middle:** Model of the completed dam project. **Bottom:** Construction site of the Three Gorges Dam.
Previous Page: The Three Gorges.

CHEN SHEN. ROM

long, and will submerge 21 cities and counties—a total of about 632 square kilometres (253 square miles) of land, about one-third the size of Lake Ontario. The cultural-heritage rescue project now being undertaken in this area began as early as the 1980s, but became intensive in the early 1990s and in the last five years, between 1997 and 2002, the project has involved 6000 specialists from more than 70 institutions of archaeology, conservation, geology, and hydrology from across China; as of July 2002 the rescue efforts had consumed 63 million RMB (Chinese currency) in costs, equal to $12 million Canadian.

It is clear that the Three Gorges Dam—one of the world's largest hydroelectric projects—will have socio-economic advantages for the developing nation. But what's troubling is that it will also have a negative impact on China's natural environment and cultural heritage management. Officially ratified in 1992, the project has generated worldwide attention, criticism, and doubt. Unavoidably, given the time constraints, archaeological missions will not be able to save all of the threatened cultural heritage, no matter how much support is provided for rescue operations. Treasures have already been lost, and as dam construction enters its third phase (see "Time Lines for Damming the River," right) more losses will surely follow. And new findings suggest that exciting new evidence from paleolithic cultures in the Three Gorges area—findings with tremendous significance to the civilized dynastic period—may be lost forever before they can be fully explored.

Intensive rescue efforts began in the Three Gorges area in 1993 with the largest archaeological survey in China's history, undertaken by more than 300 archaeologists from 30 universities and museums across the country. These experts assessed the quality and quantity of ancient relics and cultural-heritage sites that would be affected by the dam, which at the time was already under construction. The two-year survey covered every corner of land that would eventually be flooded by the dam's reservoir area. Even though everyone expected the cultural fallout to be considerable, the results still came as a big surprise: 1087 ancient sites became candidates for the State Administration's official heritage protection program. Some of the affected sites will be merely disturbed by the flooding while others will be completely inundated as the reservoir's waters rise to 175 metres (574 feet) above the current level. In addition, upland sites may also be disturbed when people from the reservoir areas are relocated and re-settled on them.

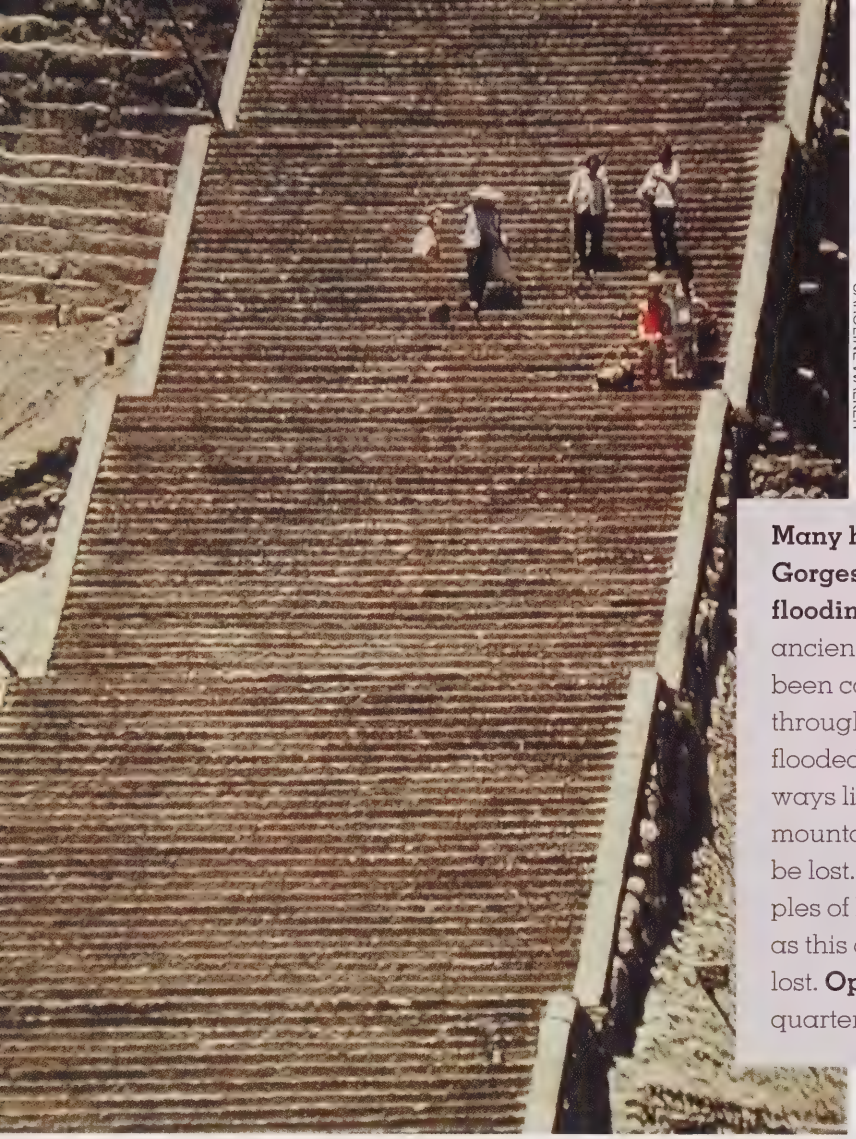
The sites fall into two broad categories: above-ground heritage sites, such as ancient historical houses, monumental buildings, stone sculptures, and bridges; and archaeological sites still preserved underground. Of the nearly 400 above-ground heritage sites, about 87 will be protected where they stand. One proposed project is an underwater museum to shelter

三峡

Time Lines for Damming the River

The Three Gorges Dam project—one of the largest hydroelectric projects ever undertaken worldwide—was ratified by the government of China in 1992. The project's first phase was completed in October 1997 when the Yangtze River was diverted to run through an open channel. Towns along the Yangtze in the western parts of Hubei province were among the first to be inundated. On November 7, 2002, successful damming of the diversion canal marked completion of the second phase of construction. According to the construction plan, by 2003 the Three Gorges power station will begin to generate electricity, and the permanent ship lock will begin operation. The inundated area will expand westward to the east part of Chongqing Municipality—a large urban district once in western Sichuan province that was promoted to an independent municipality in 1997 by the central government, because most of its population of 30 million must leave, to resettle away from the inundated area in the more urban part of the municipality.

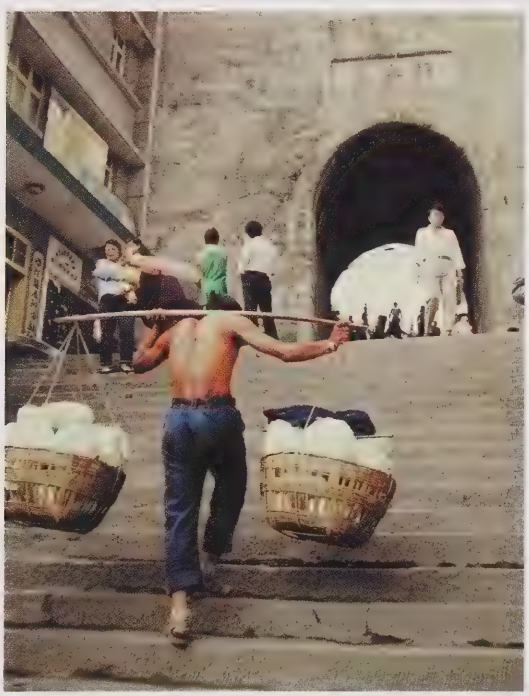
The third and final phase is planned for 2004–2009; by 2009 all 26 electricity-producing turbogenerators will be completed and begin to generate electricity at a total capacity of 84.7 billion kilowatts per hour annually. When the dam is complete—at a total investment of 50 billion RMB (C$10 billion)—the water level in the dam's reservoir area will rise 175 metres (574 feet), with the dam itself reaching 185 metres (607 feet) above the current water level.



CAROLINE WALKER

CHEN SHEN, ROM

Many historic sites in the Three Gorges area will be submerged by flooding. Top and bottom left: The ancient town of Fengjie, which has been contested by militarists throughout China's history, will be flooded. **Top right:** Ancient cliff pathways like this one carved into the mountains by early travellers will be lost. **Bottom right:** Many examples of historical architecture, such as this ancient bridge, too, will be lost. **Opposite:** Mr. Wang's headquarters for the Hubei Work Station.



CAROLINE WALKER

CHEN SHEN, ROM

the Beiheliang carved stone beams, famed for their ancient hydrographic markers—fish carved on the beams are seen when the water is at normal level, but the fish are underwater in flood season. A further 133 ancient structures will be relocated to a higher elevation. The remaining 144 historical above-ground sites will be lost—whether or not there is time to conduct the thorough field investigations that are slated for them (see "Relics Protection Measures," this page).

Two-thirds of the items on the protection list, however, fall into the second category—archaeological sites. Exactly 723 are recorded in the Three Gorges cultural heritage protection program, with a total estimated excavation area covering 17 million square metres (182 million square feet)—about four times the size of downtown Toronto. Most of the sites were discovered for the first time during the survey, some revealing distinct cultural features never seen before. The losses here extend beyond the physical disappearance of the sites, for there may be naiveté about how much information can be attained from the recovered objects themselves. If sites are excavated merely for removing ancient objects without any attempt to reconstruct past ways of life—a task that requires time-consuming strategic methods of excavation and investigation—the loss of cultural heritage will be even greater than we can imagine.

My own involvement in the Three Gorges traces back to the early 1980s, when I was an archaeology student at the Wuhan University in Hubei province. I participated in a school field session, which was part of the early rescue program, before the dam project was officially ratified. (The project had been on the table since the 1950s before finally being ratified in 1992). We were excavating a Neolithic site near the current dam construction zone and camping in the Huangling Temple, which at that time was closed for restoration. The temple, originally called "temple of Bull Deity," was built about 2700 years ago to memorialize the legendary bull who helped Dayu, another figure of legend, to cut out a valley to save people from a flood. Our mission was to conduct a thorough investigation of the archaeological materials around Zhongbaodao Island. Not surprisingly, the entire island had once been inhabited. Archaeological materials show that people had lived there continuously for at least 5000 years. This discovery greatly influenced the decision of where to build the dam—given the island's long history of occupation it must be geologically stable enough to support the dam. Today the site has been completely excavated, and the island will be incorporated into the dam's concrete support structure. The temple is now a major tourist attraction near the dam.

But it wasn't until late 1999 that I realized just how seriously the Three Gorges dam would affect archaeology in China. That year, I was invited by Mr. Wang Fengzhu—chief archaeologist from the province of

CHEN SHEN, ROM

Relics Protection Measures

Some 1087 ancient cultural sites will be disturbed by flooding caused by the Three Gorges Dam now being built in China. Some relics can be protected onsite—dams will be built around sites to protect them in their current locations if they will be affected by the flooding but not submerged. The Shibao Stockade in Zhongxian County of Chongqing, for example, contains a famous 12-storey pagoda (page 26) rising to a sheer height of 56 metres (184 feet). It was built 300 years ago in the reign of Kangxi of the Qing dynasty. Because the pagoda is located on a cliffside at an elevation 173.5 metres (569 feet) above the river, only 1.5 metres (4.9 feet) of it will be under the expected water level. A dam is scheduled to be built around the pagoda base, but the stockade at ground level will be lost.

At the west end of the Three Gorges is Fengjie (page 24), a well-known ancient town more than 2000 years old. In ancient times Fengjie was a strategic town on the artery to Sichuan from east China via the Three Gorges; it has been contested by militarists throughout China's history. Soon, the town and its beautiful stone city-gate will be completely submerged. However, on a clifftop 5 kilometres (3 miles) from the town, a main building of the Baidi (White Emperor) Temple (page 26), which was built in the Ming dynasty and rebuilt in the Qing dynasty and which has been standing for more than 500 years, will be protected. Legend has it that in this place Liu Bei, the king of the Shu Kingdom (AD 221 – 263), entrusted his son to Zhu Geliang, his prime minister and a famous sage in history. When the Three Gorges project is complete, Baidi Temple—a major tourist attraction—will remain as an islet in the reservoir.

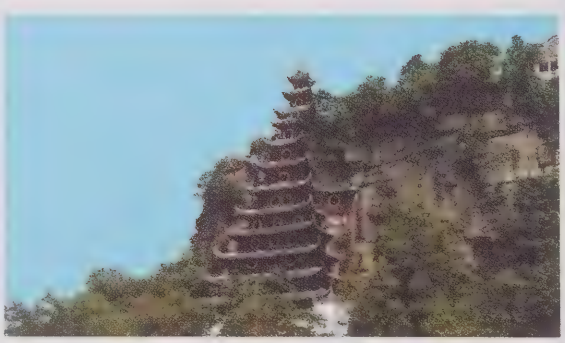
Some structures will be relocated to higher eleva-

CAROLINE WALKER

CAROLINE WALKER

CAROLINE WALKER

Moved or dammed. Clockwise from top left: This Han dynasty stone tower is is one of two in the Three Gorges area of a type not seen in Central China. It is being moved to safety; Changfei Temple, a multi-room complex with extensive gardens and balconies will be moved 32 kilometres (20 miles) upstream by 70 specialists and 245 technicians; Shibao pagoda will be dammed around its base, leaving only 1.5 metres (4.9 feet) of it under water; Baidi Temple, which has been standing for 500 years, will remain as an islet in the reservoir.



CAROLINE WALKER

Hubei who heads the State Administration of Cultural Heritage (SACH) Three Gorges Cultural Heritage Preservation Hubei Working Station, established in 1994—to make a field trip to the Three Gorges reservoir area. We visited the archaeological sites and were updated on current work in the area.

Mr. Wang and his associates had commandeered for their live-in headquarters a preserved 15th-century residence, a gorgeous multi-courtyard complex near the dam site. Mr. Wang is responsible for overseeing 335 preservation projects—those that fall in the Hubei part of the reservoir—while his counterparts at the Chongqing Work Station are responsible for the remaining 732 projects—the ones in the Chongqing territory. The two work stations coordinate the mass of specialists and resources coming in from across the country and direct the field operations of this huge project. Each archaeological or research team must sign contracts with one of the work stations: their work is monitored and evaluated according to stated objectives, procedures, schedules, budgets, data formulation, and report distribution. All original data sheets, field records, photographs, videotapes, drawings, maps, and preliminary reports—in both digital and print form—must be submitted to and remain at the work stations upon the completion of each assignment.

Two of the most difficult tasks for Mr. Wang are making annual budget proposals based on an assessment of what needs to be accomplished that year to complete the entire project on schedule, and bargaining with government engineering departments for funding to be allocated promptly to operational units in the field. "In 1996," Mr. Wang explained to me, "we proposed 61 projects to the Three Gorges Project Construction Committee (TGPCC) for a budget of 19 million RMB (C$3.8 million), based on what we encountered in the previous year. We received only one million RMB, which enabled us to complete only 20 projects and begin 3 multiple-year projects." The following year, the Hubei Working Station proposed 60 projects with a total budget of 14.7 million RMB. The TGPCC approved 54 projects but only 8.4 million RMB, leaving work undone both above and below ground. While this frustrating situation has now improved, time is fast running out.

Hubei archaeologists have faced the most challenges in rescuing archaeological sites in the first phase of the dam project. Prior to 1995, they concentrated all their resources on salvage operations within the dam construction zone, where there was a high density of important archaeological sites. After completing their work—which was limited to saving objects—within the immediate construction area, their rescue efforts have shifted to new locations in Hubei's part of the Three Gorges reservoir. They had only two years to preserve a total of 133 cultural relic/archaeological sites that were

tions. Two famous stone towers (page 26) of the Han dynasty (221 BC – AD 220), which probably stood in front of a large, prestigious family cemetery complex 2000 years ago, are one of 133 relocation projects. The style of these towers has never been seen in central China, where fewer than 30 shrine towers are preserved today. The major task, however, is the relocation of an ancient monumental structure—the Changfei Temple (page 26). Built as early as AD 1088 in the Song dynasty for the worship of a brave general, Chang Fei, who was the Marquis of Hen of the Kingdom of Shu (AD 221 – 263) in Yungyang County, the temple complex is located on the south bank of the Yangtze River near Yunyang Township. Equipped with more than 600 original wall prints, wooden carvings, and stone statues and inscriptions, this multi-room complex with extensive gardens and balconies has been a sacred monument for local rituals for more than 1000 years. The entire complex—1604 square metres (17,259 square feet)—is currently being moved, under the direction of more than 70 specialists and 245 technicians at a cost of 70 million RMB (C$15 million), to a location 32 kilometres (20 miles) upstream. It will be placed so that the scenic view is as much like the original view as possible.

The final strategy for preservation is simply to study the sites before they are submerged. The earliest site in the reservoir area is a cliff pathway (page 24) built probably during the Eastern Zhou dynasty (771 – 221 BC). There are also many rare examples of ancient Chinese architecture, including 50 temples, 150 residence compounds, 22 pavilions, and two tower stockades, all dated to Ming and Qing dynasties (1368 – 1911) that will be lost. These remains would not retain their original functional and cultural significance once removed from their original context. They are to be studied with explicit data collection (survey, mapping, photography, replication, etc.) before they are submerged.

CHEN SHEN, ROM

CHEN SHEN, ROM

CHEN SHEN, ROM

CHEN SHEN, ROM

CAROLINE WALKER

Top and bottom: By 5000 years ago, invading culture, Qujialing, brought advanced technology seen in these vessels. **Far left:** Known only to the Three Gorges area, the Daxi Culture dating 7000 to 5000 years ago left behind artifacts like this vessel. **Top right:** Daxi stone tools. **Middle:** Ba culture, also limited to the Three Gorges area, represented a unique local Bronze Age civilization. This coffin was hollowed from a tree trunk.

CHEN SHEN, ROM

affected when the river was diverted in 1997. According to a report written at the beginning of 1998, a shortfall of funding and resources meant that only 64 out of 133 planned projects were completed. Wang told me, "We warned that if the work was not carried out promptly on the remaining 69 sites before the flood season of the summer of 1998, they would be damaged permanently."

In the spring of 2000, I returned to the Three Gorges archaeological field again, after participating in an international workshop on the dam and cultural heritage management at the University of Florida. This time, I was hosted by Prof. Wei Qi of the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing. Prof. Wei is my collaborative partner in the ROM-China paleolithic project that regularly takes me to northern China. Since 1993, he had been investigating paleolithic sites in the Three Gorges reservoir area, though he is no longer participating today. I was stunned when I heard his results: a total of 54 paleolithic sites were identified for the first time in the 1993 grand survey. Before then, no one knew that such early inhabitants existed in this area. Most of the sites are located on narrow terraces of river banks between Fengdu and Fengjie of Chongqing, although some were found in the Zigui County of Hubei in Xiling Gorge. The density of these paleolithic sites is so high that they could become one of the best case studies for researching paleolithic settlement patterns. During my visit, I examined lithic artifacts (stone tools) from three of these sites all located in Fengdu County, on the southern bank of the river, and discovered to my surprise that two very different production techniques can be identified: large-pebble chopping tools—made directly from river pebble—were found at two of the three sites (Jingshuiwan and Gaojiazheng), while flake tools such as scrapers and points were predominant at the other site (Yandunbao).

The find was significant because, until then, I believed that in paleolithic China, there were two distinct lithic technologies: flake-tool industry used in the north and pebble/core-tool industry in the south. Now, however, it seems that the division between the two is not so clear-cut. At the Middle Yangtze Valley Jigongshan site in Hubei, a flake-tool industry from the end of the Pleistocene (30,000 to 10,000 years ago) has been identified. Similarly, I observed that the southern pebble/core-tool technology has been found at the south side of Qingling Mountain Ridges, a few hundred kilometres north of the Yangtze River. These newly identified paleolithic sites may represent two different technologies co-existing in the Three Gorges area. The high density of these settlements along the river, unseen elsewhere, suggests that the Three Gorges river channel served as a transit passageway—people migrated between north and south using this corridor as early as the end of the Pleistocene.

Seven of these 54 sites were partially excavated between 1995 and 2000. It is vitally important first to es-

三

CHEN SHEN, ROM

Recent investigation has revealed 70 symbols on Daxi pottery wares—the first proto-writing system discovered in southern China.

峽

tablish the chronological sequences of these sites—by applying scientific dating techniques—and to characterize their stone tool technology, before their relationships with paleolithic industries in other parts of China can be established. Until then, the following questions will remain unanswered: 1) When did the earliest modern humans first settle here? 2) Where did these earliest inhabitants come from? 3) Why did they select this environment for their settlements? 4) What were their economic strategies (fishing/hunting/gathering)? and 5) How were these hunting-gathering societies transformed into farming societies, if in fact the transformation took place locally? This new information is exciting in that it offers insight into the lives of Chinese people 20,000 to 10,000 years ago in this region.

A well-known Neolithic culture, Daxi, dated to 7000 to 5000 years ago, was recognized as early as the 1950s to be a large indigenous farming culture known only to the Three Gorges valley. Recent investigation into this agricultural society has revealed—for the first time—more than 70 different kinds of symbols, all found on Daxi pottery wares. This is the first discovery of a proto-writing system in southern China, providing important evidence for studying the origins of the Chinese writing system. By 5000 years ago, an invading culture, Qujialing, appeared in the Three Gorges, bringing advanced technology and social systems to the region. One thousand years later, the first state, Ba, arose in the region. Ba had collateral relations with states in East and Central China. Ba culture was limited only to the Three Gorges area, representing a unique and local manifestation of a Bronze Age civilization. Our knowledge of Ba remains poor—studies are still very preliminary. Recent salvage work is providing a golden opportunity to explore Ba civilization—but the opportunity will not last long.

I've discovered that many archaeologists in China see their involvement in the Three Gorges archaeological rescue project as a once-in-a-lifetime opportunity, and they are proud of the role they continue to play. In the past decade, their work has dramatically increased the understanding of human history in the Three Gorges area and has shed valuable new light on such important issues as the origins of human beings, the transition to agriculture, and the development of complex societies, ancient beliefs, writing systems, cultural interactions, and origins of state formation.

Nevertheless, Chinese archaeologists are deeply concerned about what has and will be lost, and they are equally worried about how cultural-heritage management can be properly conducted within their capabilities. But they are doing the best they can under frustrating circumstances. They should be applauded for what they have achieved during the first two phases of the dam construction, and they should be inspired by the challenging future that lies ahead. ■

Two paleontologists unravel clues to the identity of a dinosaur skull,

How to ID a Dinosaur

discovering a species never seen before.

The close relative of the domed dinosaurs, the horned *Psittacosaurus*, above, was vital for working out the relationships of pachycephalosaurs

By Thomas D. Carr

In the summer of 1998, researcher Paul Sealey was in the San Juan Basin of New Mexico looking for fossils with dinosaur expert Dr. Thomas E. Williamson when he spotted an unusual skull. The basin's extensive badlands, which feature exposed rocks deposited at the end of the Age of Dinosaurs and the start of the Age of Mammals, has been a popular place for paleontologists for more than a century. The fossil that caught Paul's eye was embedded in a rock unit 73.5 million years old. Called the De-na-zin member of the Kirtland Formation, this was the same location in which a spectacular skull of a crested hadrosaur had been discovered several years before. Dr. Williamson immediately recognized Paul's find as a rare dinosaur skull, the first of its kind ever found in the state.

Well-preserved ancient life forms are paleontological gems. Often, they hold new evidence, helping paleontologists to piece together the relationships and histories of prehistoric life. Identifying a new species takes us one step further towards understanding the history of life, and reminds us of just how much we still don't know.

The new dome-headed *Sphaerotholus buchholtzae* (foreground) surrounded by its close relatives (from left to right) *Stygimoloch*, *Stegoceras*, and *Pachycephalosaurus*.

BRIAN BOYLE ROM

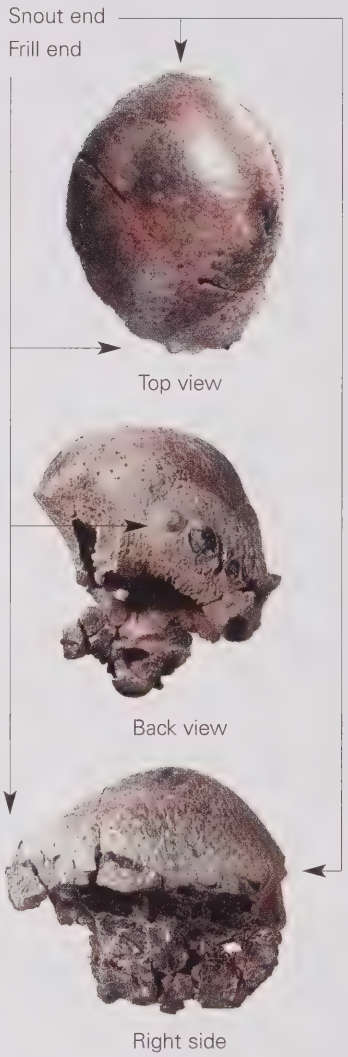
It turns out that the skull is of a rare plant-eating dinosaur, which belongs to the group called Pachycephalosauria, or "thick-headed reptiles." At 3 metres (almost 10 feet) long and wide in the belly, hips, and tail, this dinosaur would have walked on its long hind legs. Its beak-tipped mouth is lined with short fang-like teeth at the front and a row of delicate leaf-shaped crowns behind. Some of the species had a spectacular dome extending from the short frill that encircles the back half of the skull. Both frill and dome-base bristle with small ornamental spines, which extend onto the side of the face like rows of jewels, and continue above the eyes and down the cheek.

This group of unusual plant-eating dinosaurs lived in northern Europe, Asia, and western North America between 130 and 65 million years ago. Tolerating both arid and humid environments, pachycephalosaurians shared their subtropical world with ceratopsians, hadrosaurids, and giant predatory tyrannosauroids, as well as small fluffy predators, such as dromaeosaurids.

Judging from the fossil record, pachycephalosaurians appear to be among the scarcest dinosaurs from the Late Cretaceous (83–85 million years ago)—only four skeletons, all incomplete, have been found and described so far. Yet paleontologists recognize more than a dozen species, known mostly from isolated skull roofs and domes like the one found by Paul Sealey.

Paul's newly excavated specimen was excellently preserved and surprisingly complete, prompting Dr. Williamson to begin a scientific study of it. He invited me to join him in working out the dinosaur's identity, anatomy, and—if it turned out to be a new species—its evolutionary relationships to other pachycephalosaurids. The timing of the discovery was opportune; Dr. Williamson and I had just started a long-term research project on tyrannosauroids of New Mexico and had already made plans to visit several museums where pachycephalosaurians would also be available for study. Up to that point, tyrannosauroids were my sole research subjects, and Dr. Williamson was an expert on hadrosaurids and ceratopsians. But this was an opportunity to broaden our expertise and we couldn't pass it up.

Our first step was to find out whether the specimen represented a new species. Dr. Williamson took on this detailed and arduous task since, at the time, I was in the midst of my Ph.D. dissertation on tyrannosauroid evolution. For the next several months, he pored through the voluminous scientific literature published on pachycephalosaurians and compared the new specimen with casts of other species. In North America, three well-known genera of pachycephalosaurians—all of which belong to a subgroup with domed skulls, called pachycephalosaurids—existed. They are *Stegoceras*, *Stygimoloch*, and *Pachycephalosaurus*, which, with a 60-centimetre-(almost 2-foot-) long skull, was the largest of all the pachycephalosaurians. He was elated to conclude that the dome indeed belonged to a previously unknown species. Although 35 species of dinosaur are known from the 75-million-year-old rocks of southern Alberta, only a few species are known from that time in the southwestern United States. The new dinosaur differed from all other pachycephalosaurids in several ways: when viewed from behind, its frill becomes shallow towards the sides and bears a single row of nodes; as well, there is one node on the bottom corner of the frill. These unique characters are called diagnostic characters, because they distinguish one species from another. Dr. Williamson and I named the new fossil *Sphaerotholus* ("sphere-dome"), for the ball-like appearance of its dome when viewed from above.



Sphaerotholus goodwini

The next question for us was, where does the new species fit into the big picture of pachycephalosaurian evolution? As a group, the "thick-headed reptiles" belong to the grand dinosaur lineage called Ornithischia, a clade, or group that includes a single recent common ancestor and all of its descendants (recent refers to the one ancestor from which all of the species in the clade originated). Evidence of clades is found in skeletons—we know that Ornithischia is a clade because all ornithischians have a lower jaw that ends in the predentary bone, which fits onto the front of the dentary, or tooth-bearing bone; the lower jaws of all other land animals end with the dentary bone. This single bone tells us that all ornithischians descended from one common ancestor. These shared evolutionary novelties—called derived characters—are the evidence used to infer recent common ancestry.

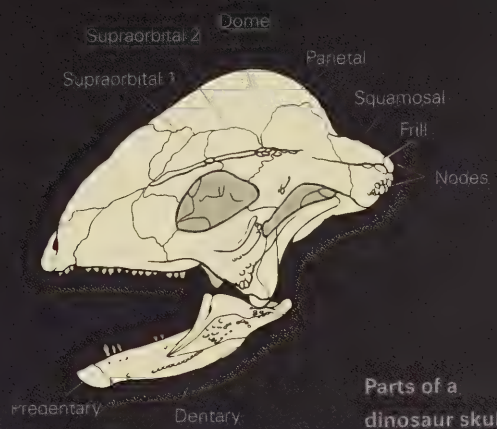
Clades can exist within larger clades. Pachycephalosauria itself is a clade: all pachycephalosaurians have a thick and bristly skull roof with small bumps of bone on the back corners. Several extra skull bones identify pachycephalosaurians, including two above their eyes and up to three that separated the eyes internally—most dinosaurs had only a partition of cartilage.

Our first task in finding the answer to where *Sphaerotholus* fits within the larger group of Pachycephalosauria was to iden-

© THOMAS WILLIAMSON

Sphaerotholus and its relatives

Below are several representations showing how *Sphaerotholus* fits in to the larger group of dome-headed dinosaurs. In the cladogram below, each segment of the stem represents the ancestors, and the known species are at the end of each branch. The characters that diagnose—or identify—each clade evolved in each ancestor, and thus appear at each stem. Black patches on the skulls below indicate missing bone; darkened areas indicate recessed areas.



Parts of a dinosaur skull.

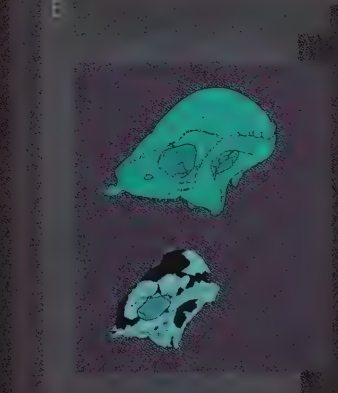
- *Sphaerotholus goodwini*
- *Sphaerotholus buchholtzae*
- *Pachycephalosaurus wyomingensis*
- *Stygimoloch spinifer*

1. dome present on skull roof
2. parietal and squamosal bones contact each other
3. frill extends down to the sides at a steep angle
4. frill becomes shallow at the sides

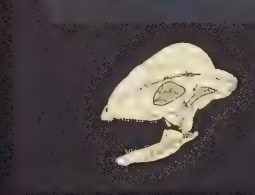
- *Prenocephale prenes*
- *Tylocephale gilmorei*
- *Stegoceras validum*

'Goodwin's sphere-dome', named in 2002, collected from the southwestern USA.

'Thick headed lizard from Wyoming' is the largest known pachycephalosaurian; 'Bizarre spined denizen of the river Styx' has the narrowest dome.



'Inclined slope-head,' the most complete pachycephalosaurian skull collected from Asia; 'Gilmore's swollen-head' also from Asia.



'Strong-roofed horn' was first named in 1902. The genus is known from dozens of domes.

Evolution in time and space: Pachycephalosaurids probably first evolved in Asia but the sequence of their movement between North America and Asia is unclear. (Thicker sections [illegible] is in millions of years.)

© THOMAS D. CARR / PETER ENNESON

Head-Butting Controversy

Did "Thick-Headed Reptiles" Bash Their Domed Heads Together?

The spectacular dome seen in one group within the pachycephalosaurians, called Pachycephalosauridae, is the most distinctive and famous character of pachycephalosaurids, and paleontologists have long speculated on its function. Studies of the dome's physical properties and the form of other bones, especially vertebrae, have been used to suggest that pachycephalosaurids butted heads, possibly in the competitive prelude to courtship.

Confirming this would require direct observation of behaviour, which extinction has placed beyond our reach. When studying extinct species, scientists often look to living animals for a species with a similar adaptation. But, simply stated, in this case there isn't one. Still, if we consider living dinosaurs—birds—and the closest living dinosaur relatives—crocodilians—we might be able to account for the evolutionary context of the dome.

Dinosaurs, crocodilians, and their single common ancestor form a clade called Archosauria, the "ruling reptiles." Dinosaurs and crocodilians, which are clades in and of themselves, inherited the behaviours of their most recent common ancestor—presumably those behaviours common to both clades. Unlike most living vertebrates, living archosaurs lack the ability to detect pheromones and so are highly visual animals whose display structures and stereotyped body language are important for communication among members of the same species. Indeed, many extinct dinosaur species had horns, frills, crests, ridges, and domes on their skulls. Even *Tyrannosaurus rex* had a coarse ridge on its snout and two sets of horns on its face. So, for extinct dinosaurs as well, visual communication seems to have been important.

It is probable that extinct dinosaurs, including pachycephalosaurians, had these structures for communication, as do living archosaurians. Just as with the casques and crests of living birds, such as hornbills and blue jays, the thick skull roofs and domes were primarily visual in nature. This conservative inference is based on evolutionary relationships of dinosaurs and observable behaviour in their relatives. Although any hypothesis of dome function is virtually untestable, if the domes were primarily visual, as the evolutionary evidence suggests, it is improbable that pachycephalosaurians bashed their heads together in the manner of bighorn sheep.

Studies of the internal structure of the pachycephalosaurid dome are consistent with this notion. The domes grew rapidly and were lightweight, virtually hollowed by hundreds of minute and parallel vascular canals. Since the domes were relatively spongy and received a massive blood supply, it would have been difficult for the pachycephalosaurians to butt heads without injury. While head butting might be a dramatic and more attractive hypothesis, it requires a behaviour that is beyond the repertoire of living archosaurs.

tify characters that would reveal the closest relatives of the new dinosaur. This was challenging because most pachycephalosaurid fossils are simply domes, a very limited source of anatomical information. I was accustomed to working on tyrannosauroids, which are represented by multiple complete, or nearly complete, skeletons and skulls. Fortunately, at the ROM I had access to the Palaeobiology Department's collection of domes and cast skulls, a collection that includes every major North American species.

As we investigated the fossils at various museums, Dr. Williamson made a surprising discovery of his own. While studying a drawer of domes at the Royal Tyrrell Museum of Palaeontology in Drumheller, Alberta, he came across a specimen from Montana that had the diagnostic characters for *Sphaerotholus*. The Montana dome—collected from the Hell Creek Formation, a unit of rock deposited between 67 and 65 million years ago—was much younger than the specimen Paul Sealey had found in New Mexico.

The Montana skull differed from the New Mexico find in other ways as well: the bone that makes up the back half of the dome—called the parietal bone—is so wide where it joins the frill that nodes overlap onto it. On the New Mexico species the parietal is just a narrow slip, easily fitting between the nodes. As well, the frills and nodes differ slightly in size and placement.

These differences indicated to us that the Hell Creek skull was a different species from the New Mexican one. We named it *Sphaerotholus buchholtzae*, in honour of Dr. Emily Buchholtz of Wellesley College, Massachusetts, who is an expert on pachycephalosaurian anatomy. The New Mexico skull we named *Sphaerotholus goodwini*, after Mark Goodwin, of the University of California's Museum of Paleontology, an expert on North American pachycephalosaurians.

Though not an infrequent event in paleontology, the opportunity to describe and name a new genus and two new species of pachycephalosaurid was quite a thrill. These new findings would also give us additional pieces for our puzzle.

Our next step was to conduct a cladistic analysis using the characters we had found. In cladistics, analysis begins with the ingroup, that is, all the species in the group whose relationships we want to reconstruct—in this case Pachycephalosauria. Our detailed comparative study uncovered characters that indicate subgroups within Pachycephalosauria; for example, some pachycephalosaurians have domes and others do not.

The challenge is to discover which character state is the evolutionary novelty. This is where the outgroup comes in; an outgroup is one or more species that do not belong in the ingroup—for our study, we chose *Psittacosaurus* (parrot lizard) as our outgroup—a primitive genus of ceratopsian and also the clade that is most closely related to pachycephalosaurians. The absence of a dome in both *Psittacosaurus* and some of the pachycephalosaurians tips the balance toward the dome's being an evolutionary novelty.

Dr. Williamson and I had identified 21 characters for pachycephalosaurians from our own study of various specimens, and we culled an additional 32 from the scientific literature. The 53 characters were entered into a software program that uses an algorithm to reconstruct evolutionary relationships.

The result of a cladistic analysis is a branching diagram, a cladogram, which shows smaller groups within larger groups (see page 35). Each branching point represents a speciation event, in which the ancestor group splits into two species. The cladogram also provides the reference for finding the larger-scale changes that affected the evolution of a clade, such as a seaway separating a continent into two, thereby splitting an ancestral species into two daughter species.

Cladograms also turn up gaps in the fossil record. For instance, our results showed that *Sphaerotholus* belongs within the subgroup Pachycephalosauridae—because it possesses a domed skull. The oldest pachycephalosaurids are about 80 million years old, whereas the oldest pachycephalosaurians (the larger group that includes pachycephalosaurids) are from rocks older than 125 million years, indicating that there is a gap of 45 million years in the fossil record for the group. This gap means that the recent common ancestor of Pachycephalosauridae evolved sometime between 80 and 125 million years ago. Also, these facts imply that the diversity that we currently know is a fraction of what existed.

Sphaerotholus goodwini

Our findings showed two things. First, *Sphaerotholus* belongs to another exclusive clade within Pachycephalosauridae. This group is Pachycephalosaurinae, identified by several skull bones that join in unique ways and muscle scars on the skull that have a unique pattern. Second, *Sphaerotholus* shared a recent common ancestor with *Stygimoloch* and *Pachycephalosaurus* because all three have a similar frill that slopes steeply downward when viewed from behind. So, the clade-within-clade sequence for this group goes, from largest to smallest: Pachycephalosauria-Pachycephalosauridae (those genera with domes)-Pachycephalosaurinae (all those genera with domes except *Stegoceras*).

With this information in hand, Dr. Williamson and I began to wonder if the evolution of pachycephalosaurians was in any way affected by the geological history of Asia and North America. This branch of natural history is called historical biogeography. The specimens we studied included species from Asia and North America, because the two land masses were united sometime between 125 and 100 million years ago by a land bridge—Beringia. Formation of the bridge was a significant event in the evolution of northern dinosaurs; in both Asia and North America, by 100 million years ago, the dinosaur faunas had changed overnight—in geological terms. It is less clear whether Beringia remained above sea level after 100 million years ago, but a later faunal change shortly before the Great Extinction suggests that the bridge was re-established at that time.

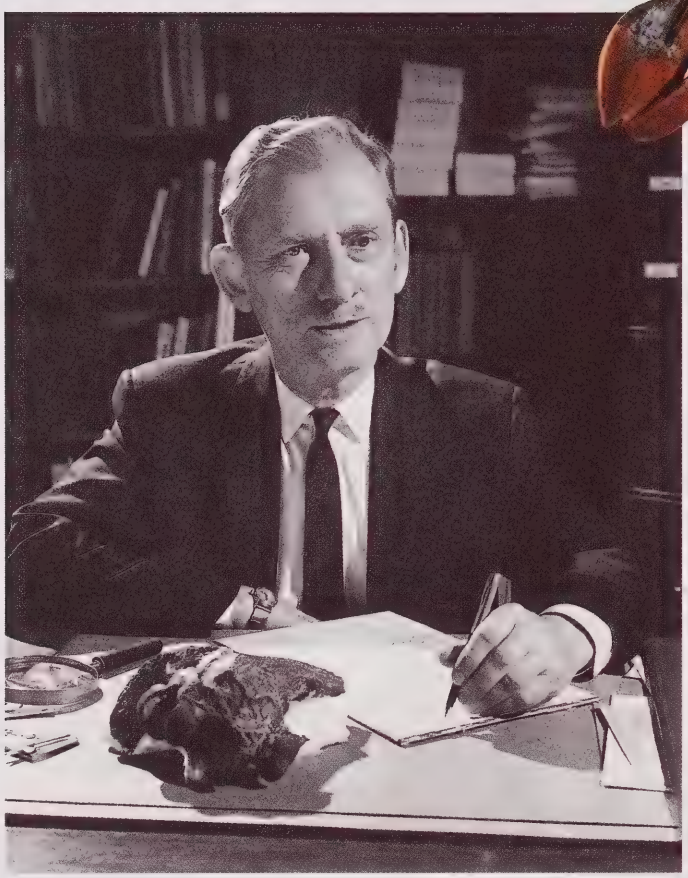
We can see dinosaur travel patterns based on the cladogram and geographic distribution of each species. Among our pachycephalosaurids, five genera are from North America and two, *Tylocephale* and *Prenocephale*, are from Asia. When we combine these data we can reconstruct the geographic location of the ancestors by using algorithms—one algorithm assumes that changes occurred early and the other assumes that they occurred late.

We worked up two equally possible scenarios. Either the recent common ancestor of *Stegoceras* and the clade Pachycephalosaurinae speciated in Asia and then the two clades travelled independently into western North America—leaving *Tylocephale* and *Prenocephale* behind in Asia, or the common ancestor of all dispersed from Asia to North America, where each species arose, and then *Tylocephale* and *Prenocephale* went back to Asia. Currently there isn't enough data for us to decide which scenario is correct.

The work that Dr. Williamson and I have done on pachycephalosaurids is the first step in a long-term project on the evolution of pachycephalosaurians and tyrannosauroids. Our aim is to learn about the major natural forces that drove dinosaur evolution during the close of the Age of Dinosaurs. Since we can't travel back to the Cretaceous to watch the day-to-day habits of *Sphaerotholus*, we must continue to look for clues about the many undiscovered species of pachycephalosaurians that keep secret, for now, a vast evolutionary story waiting to be told. ■

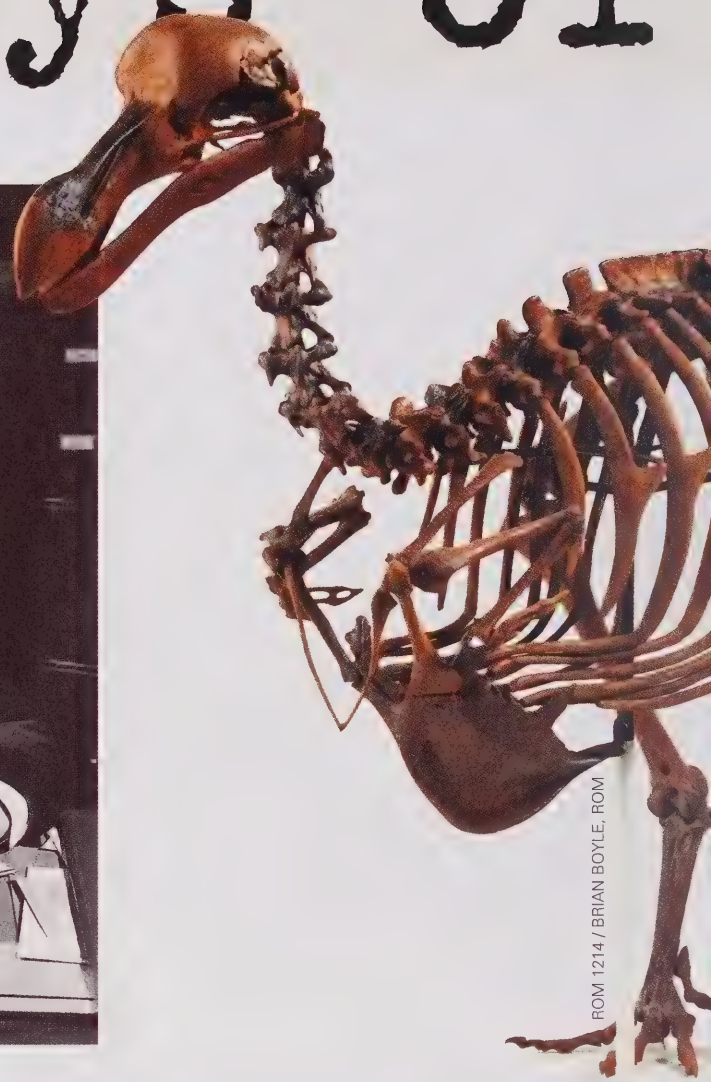
© DINO PULERÀ

Ways of



ROM ARCHIVES

Dr. Loris Russell.



ROM 1214 / BRIAN BOYLE, ROM

Sixty years ago, when a mere handful
the ROM owned one. Assistant curato
managed to acquire it—and explores w

Last October, while searching the ROM archives for some field notes of former curator Dr. Loris Russell, I chanced upon a file labelled "ROM Dodo." I had known that the ROM had a real dodo skeleton in its collections, but the catalogue card for it is one of those ancient, barren records that gives no clue as to how the specimen came to be here. (This is not because early cataloguers were lazy; early ledgers had only five

the Dodo

By Kevin Seymour

Reconstruction of dodo painted by Dr. Loris Russell.

dodo skeletons were known worldwide,
Kevin Seymour reveals how the Museum
t researchers have discovered since.

columns, so usually only five kinds of information were recorded for each specimen, whereas today we log up to 75 fields of information.)

Inside the Dodo file, I discovered an intriguing article written by Dr. Russell in 1938, a goldmine of information about the ROM specimen. It had never been published. The following draws in part from Dr. Russell's lengthy article to tell the story of how the ROM came to own a dodo skeleton, one of just a handful that were known

worldwide at the time that it was acquired.

The large, flightless dodo (*Raphus cucullatus*) was once a denizen of the island of Mauritius in the Indian Ocean, off the east coast of Africa. Portuguese seafarers first discovered the island in the late 1500s, but there were no visual records of the bird until a Dutch explorer by the name of De Bry published the first crude engraving of a dodo in 1601. Over the next 10 years, various other Dutch explorers visited the island—and consumed vast quantities of the birds, storing them as provisions for the continuation of their voyages. In 1617, Pieter van der Broecke made the first known drawing of a live dodo.

Recent studies suggest that European paintings may not be truly indicative of the dodo's appearance in life. The images were based on the fattened birds that survived the voyage to Europe by eating biscuits.

Within the next 20 years, several live specimens were brought back to the Netherlands. Two artists, Roelandt Savery and his son Johannus, made a series of paintings based on the birds in the Dutch zoological gardens. One live dodo made its way to London, England, where it was exhibited in 1638. (Eventually this individual became a stuffed specimen in the Ashmolean Museum at Oxford University.)

The last record of a live dodo sighting was made by Benjamin Harry, who visited Mauritius in 1681. Subsequent voyagers to the island in 1693 made no mention of the dodo, although they did note the destructive habits of the introduced hogs—undoubtedly a factor in the dodo's demise. Being a flightless bird, the dodo had no means of escape from the voracious hogs, dogs, (humans), and other introduced European animals. And because the dodo nested on the ground, its eggs and young must have been particularly vulnerable. By 1700, less than 100 years after the dodo was first described, it was extinct.

A complete census of dodo remains in the world's museums at that time would have included a single foot at the Royal Society of London, a skull in the Copenhagen Museum, and the stuffed specimen at Oxford. In 1755, however, the by then ratty Oxford dodo was condemned and incinerated; only the head and one foot were saved.

But after 1848, when British zoologists Strickland and Melville published a book on the dodo, things changed. In the book, the authors made the prophetic suggestion that a search for fossil bones on Mauritius might reveal further specimens for scientific study. When the great English anatomist Sir Richard Owen had a chance to talk with the Bishop of Mauritius in 1863, he was probably mindful of this suggestion. We can guess that he made a plea for specimens; just two years later, the Bishop wrote Sir Richard to say that a Mr. George Clark, a local schoolteacher and naturalist, had discovered some fossil bones of the dodo in a bog almost 5 kilometres (3 miles) from the town of Mahébourg. In that area, the outlet of a ravine had been dammed by an accumulation of sand—the dodo bones were preserved in the black muck, which stained them a dark brown, a colour you can still see on the ROM specimen today.

Clark shipped several lots of dodo bones to Sir Richard, who selected the best ones for the British Museum. He wrote his classic scientific treatise, *Memoir on the Dodo*, based on his study of these specimens. The remaining bones were sold at public auction, and two incomplete skeletons eventually made their way to Harvard University, in part through the influence of a famous naturalist who worked there at the time, Louis Agassiz. In 1938, one of these skeletons was offered to the ROM through James Fleming, a well-known Toronto ornithologist.

Later that year, Dr. Madeleine Fritz, then assistant director of the Royal Ontario Museum of Palaeontology, arranged a deal whereby Harvard received an unprepared skull of the horned dinosaur *Anchiceratops* from Alberta in

exchange for the dodo skeleton. This made sense—the ROM had two such dinosaur skulls and the Museum of Comparative Zoology at Harvard had two dodos.

After a troubled border crossing, where sales tax was levied on the specimen, the dodo finally arrived at the ROM. There was much excitement among staff about putting a dodo on display for the first time in Canada. Upon unpacking it, Russell realized that the skeleton was mounted in an unnatural pose, and that no attempt had been made to restore bones that were missing. Based on the best of Roelandt Savery's paintings, ROM technicians re-mounted the skeleton in a more natural pose and the missing bones were modelled, cast in plaster or plastic wood, and placed in position. It is in this form that the dodo appears in the ROM's Currelly Gallery today.

After receiving the skeleton, Loris Russell—also an amateur artist—painted his own version of Savery's painting; it still hangs on the wall in the Palaeobiology Department. So, the ROM has both a skeleton of the bird and an image of how it would have appeared in life. The only problem is that recent studies by Andrew Kitchener, a scientist at the Royal Museum of Scotland, have suggested that European paintings like Savery's may not be truly indicative of the dodo's appearance in life. The images were based on the fattened birds that survived the voyage to Europe by eating biscuits, whereas drawings done from life on Mauritius showed a much slimmer bird. Newly rediscovered Dutch paintings from this time period agree with Kitchener's slimmed-down version.

Kitchener also studied additional bones from the Mare aux Songes swamp on southeast Mauritius that have been collected by naturalists and travellers over the years; several hundred of these bones are now in the Zoology Museum of the University of Cambridge and the Natural History Museum in London, as well as in the Port Louis Natural History Museum in Mauritius.

Recent studies on these dodo remains have supported Sir Richard's claim that the dodo is a member of the pigeon family, and that its closest relatives are other now-extinct flightless relatives from two other nearby islands, Réunion and Rodriguez.

Other studies suggested that the dodo, being the largest native land animal on Mauritius, might have been a critical link in the germination of the calvaria trees on the island. Although nothing is known about the dodo's food habits, its great hooked beak indicates that it was either a flesh or fruit eater. Tree researchers have noticed in recent decades that no calvaria trees have germinated on Mauritius for almost 300 years, and that perhaps the dodo was needed for dispersing the seeds, or that the bird's digestive juices were required to stimulate germination. The latter would lend credence to a report by Sir Thomas Herbert—who visited the island in 1627 and published a book on his travels in 1634—that the digestive forces of the dodo's stomach were so powerful that they could dissolve large stones!

©THE TRUSTEES OF THE NATIONAL MUSEUMS OF SCOTLAND

Andrew Kitchener's model of a slimmer dodo.

Ever since Dr. Loris Russell originally penned his article on the ROM dodo in 1938, there has been continued research on this amazing bird. Today, much more information is available on the dodo than in Russell's day, and you can read about it on the Web, at sites such as "www.davidreilly.com/dodo." But nothing compares with viewing the skeleton of the real thing, which still inspires contemplation of the dodo's sad demise. ■

ROTUNDA

ADD TO YOUR COLLECTION

SCULPTURE AND THE VIRGIN | KOREA'S CULTURAL RICHES
ROTUNDA
The Enigmatic Hoatzin
A 200-year-old question answered
Dinosaur Ancestors
Hunting for evidence in the desert of Uzbekistan
FALL | WINTER 1999
SPECIAL BONUS: ROM NEWS INSIDE | TERRIBLE DINOCARIDS
ROTUNDA
In Vogue in Ancient Egypt
How the beautiful people kept up appearances

SUBSCRIBE NOW

Order a year of Rotunda *and you'll have the world at your fingertips. From ancient civilizations to scientific breakthroughs,* Rotunda *brings you a world of discovery. Our writers will take you with them as they solve ancient mysteries, look in depth at the wonders of nature, tackle the tough questions of conservation and ecology, and examine the arts of humankind throughout the ages.*

For just $12.84 (including GST) you will receive three colourful, illuminating issues, delivered right to your door. With so much to discover, you'll want to be sure you receive every issue. Subscribe now and add to your collection.

ROYAL ONTARIO MUSEUM • 100 QUEEN'S PARK • TORONTO, ONTARIO M5S 2C6 • (416) 586-5546

THE MAGAZINE OF THE ROYAL ONTARIO MUSEUM

Edifice & Eglantine

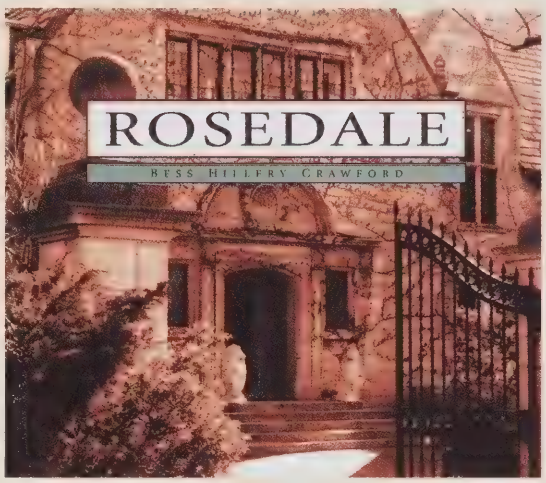
FEATURE REVIEW

Rosedale

By Bess Hillery Crawford

(Boston Mills Press, distributed by Firefly, Cloth: $49.95)

Rosedale, by Bess Hillery Crawford, is a chronicle in word and image of the leafy "oldest suburb" of Toronto. Crawford has sifted through—and pored over—archives of material. At the time of Rosedale's origins in 1824, when William Botsford Jarvis bought a 110-acre estate on the east side of the Yonge Street Highway, just north of the Bloor Street city limits, most of Toronto (still called York until 1834)—and especially its establishment—lived clustered along the city waterfront. The site of the Jarvises' first house, "Rosedale," named by Mary Jarvis, inspired by the proliferation of wild roses on the property, was situated at what is now the northwest corner of Rosedale Road and Avondale Road. While the Jarvises originally owned West Rosedale, East Rosedale was the domain of the Helliwells, from Todmorden, in West Yorkshire, England, who built a brewery, distillery, and malt house on the Don River. Eventually, the Helliwells migrated eastward, establishing mills on the Highland Creek, just below Highland Creek village. Jordan Post, who had owned 15 acres in Muddy York at Yonge and King streets, migrated to Highland Creek also, in 1834, and is buried in the Wesleyan Methodist cemetery there. (Celebrated ROM and University of Toronto entomologist Dr. Frederick Urquhart, who discovered the overwintering site of the Monarch butterfly, lived and researched at Highland Creek as well, just above the former site of the Helliwell mills, adjacent to the University of Toronto at Scarborough).



The topography of Rosedale, especially its winding ravines, which resulted in a layout of streets conforming to natural geographical contours, is a factor of its magic, as was historically its perch above the once-pristine Don Valley. Crawford details the chronological development of Rosedale through the 19th and 20th centuries, giving glimpses also of its immediate environs. Archival watercolours of Joseph Bloor's Don Valley brewery, the blockhouse at Yonge and Belmont (ordered by Governor Bond Head after the Rebellion of 1837), and the brickyards at what is now Ramsden Park (whose red and yellow bricks were used to construct many Rosedale edifices), along with old photos of such 19th-century Rosedale landmarks as the Red Lion Inn, offer a window into Regency and Victorian Toronto. Features include "The Original Rosedale Estates," "Street Names: Their Origin and Evolution," "Rosedale Architects," and "The Architecture of Rosedale Homes." Chronologically, Rosedale homes exhibit principally the following architectural styles: Italianate (1850–1880), Second Empire (1860–1880), Richardsonian Romanesque (1880–1890), Queen Anne (1880–1900), Colonial Revival (1880–1955), and Tudor (1890–1940). There are vignettes of historic Rosedale properties, including Rosedale House (1824), Drumsnab (1834), Chestnut Park (1850–55), Caverhill (1855), Idlewold (1859), The Dale (1862), Denbrae (1876), Lorne Hall (1876), Hollydene (1876–1880), the Thom House (1881), and the Guiseley House (1885). Through archival newspaper and catalogue advertisements, Crawford endeavours also to spotlight aspects of Rosedale fashion, furniture, and furnishings. There is even an ad for beds, cots, and other items designed for recumbence, manufactured by an "upright" man.

In the 20th century, Rosedale was immortalized in a number of literary works, novelist Hugh Hood's evocations of north Rosedale among them.

COMPILED AND REVIEWED BY GLEN ELLIS

The Restaurant of the ROM

Jamie KENNEDY at the Museum

Enjoy the culinary creations of renowned chef Jamie Kennedy in one of Toronto's most celebrated restaurants. Join us for lunch and indulge your senses.

Located on the fourth floor of the Museum, **JK ROM** is open daily. JK ROM will be closing on April 30, 2003 due to Renaissance ROM renovations.

For more information call the OFFICE OF SPECIAL EVENTS AND GROUP SERVICES at the ROM.
Tel: (416) 586-5572
Fax: (416) 586-5792
Web: www.rom.on.ca

The Oxford Book of Oxford

By Jan Morris
(Oxford, Paper: $26.50)

CITY OF DREAMING SPIRES, Oxford has inspired reams of literary comment, on balance positive, sometimes rhapsodic. Thomas Hardy's aspiring Jude Fawley (*Jude the Obscure*), from the roof of a barn at fictional Marygreen, strives for even a glimpse of the fabled city, elusive in the mists of dusk: "Some way within the limits of the stretch of landscape, points of light like topaz gleamed. The air increased in transparency with the lapse of minutes, till the topaz points showed themselves to be vanes, windows, wet roof slates, and other shining spots upon the spires, domes, freestone-work, and varied outlines that were faintly revealed." It was Oxford, he concludes, "either directly seen or miraged." (Alas, miraged in the case of this supplicant).

Morris's book of quotations about Oxford draws upon 800 years of comment on a wide variety of topics and personages. Much more than flannels and boaters, and sculling on the Isis, the work is a chronicle of the university itself, from its founding (described by the author as "imperceptible" and attributed variously to an ancient British king, Arviragus; Saints Neot and Grymbald; and Alfred the Great) to the end of the 20th century.

Glen Ellis is head of Publications, Royal Ontario Museum.

ROM BOOKS

ROM books are available at select bookstores and galleries.

The ROM Field Guide to Wildflowers of Ontario

Richard Dickinson, Deborah Metsger, Timothy Dickinson
(ROM, M&S, Deluxe Paper: $27.99)

THE SEQUEL to the acclaimed *ROM Field Guide to Birds of Ontario* (2001) and *ROM Field Guide to Amphibians and Reptiles of Ontario* (2002), the newest ROM guide examines the most likely to be encountered of the province's more than 1200 wildflower species. The authors focus on habitat, colour, flower arrangement, and leaf arrangement, highlighting the family characteristics that will ultimately enable users of the guide to relate even the most obscure specimens to larger patterns.

The book is photographically stunning. Drawing from the ROM's collection of more than 50,000 full-colour botanical images, including those by acclaimed naturalist photographers Mary Ferguson and Richard Saunders, the authors have selected the 1000 that best illustrate the identifying features of the species described. Whereas in most guides each species account includes a single photograph of a plant's infloresence (the flower or flower cluster), supplemented by monochromatic line drawings that attempt to explicate the plant's other identifiers, the ROM guide reveals all of the identifiers photographically. Available May 2003.

What Worms Left Behind

Resembling ancient tree roots, these fossilized remains are evidence of life on an ancient seafloor.

Dear ROM,

During a visit to the Royal Ontario Museum we became fascinated with the rock/fossil collection. The attached photograph is of an interesting fossil display we discovered recently along a gorge near Grimsby, Ontario.

The rock bears a remarkable fossilized tree root imprint, which we thought might be of interest to the ROM. For your additional information, the rock measures approximately four feet by four feet and is perhaps a foot thick, probably weighing 400 to 500 pounds.

Bert Monster and Lawry Ellis
St. Catharines, Ontario

PHOTO BY MR. LAWRY ELLIS

The fossil slab spotted by Bert Monster and Lawry Ellis near Grimsby, Ontario.

Dear Bert and Lawry,

Fossils in southern Ontario often masquerade as something quite different from what they actually represent. Your rock is covered not with tree root impressions, but with fossilized burrows of ancient marine worms. They date back to the Early Silurian Period, about 430 million years ago, a time when there were no trees on land—and in fact there was no land in the Grimsby area; most of the province was covered by a tropical sea.

People think of fossils as the preserved remains of ancient animals and plants. In the Palaeobiology Department, our preferred definition of "fossil" is "any evidence of past life, preserved in rock." Fossils need not represent the actual remains, but can also be evidence of the activity of animals. The Spring 2002 *PaleoScene* described the stationary resting trace of a large trilobite. It was identified with the trilobite because of the marked similarity between the outline of the trace and the actual remains of the animal found as fossils elsewhere. Fossil remains of trilobites are common. The vast majority of animals living in the past did not have any hard parts

JANET WADDINGTON

(shell, bones, teeth) and usually left no enduring sign of their existence; we recognize their tracks and traces by looking for living animals that leave similar clues.

On the sea floor, there is a great deal of organic detritus in the mud. Many types of worms and other creatures today derive their nourishment by ingesting mud, extracting the nutrients, and excreting the indigestible particles. On your rock, the criss-crossing lines are infilled burrows made by worms as they literally

TOUGH CHOICE

SWAROVSKI SLC OR EL

BETTER OR BEST... that's what it comes down to. Both the SLC and EL binoculars have "Swarobright" Interference Mirrors on their Roof Prism systems that deliver the largest amount of "color correct" light when compared to all other binoculars. This is why Swarovski's images are so brilliantly sharp and clear from edge to edge. The optical formula, glass, precision polishing and the "Swarotop" and "Swarodur" exterior and interior multi-coated lenses are the finest in the world.

Because they are machined from a solid magnesium casting, the newer, close focusing EL's are a little lighter in weight, and feel just great in your hand. The SLC's feel a little heavier (about 142 grams), and are as tough as a bull. The SLC's costs a little less than the EL's, but bear the same warranty. One is green and the other is a darker green. One is better than *any other binocular on the planet...* that is, except for the one that is the very best! You decide. "It's your Tough Choice".

For more information, please contact your local Swarovski dealer or visit our website at www.kindermann.ca.

SWAROVSKI
OPTIK

WITH THE EYES OF A HAWK

KINDERMANN (CANADA) INC. #3-361 Steelcase Rd. W. Markham, ON L3R 3V8
Tel: 905-940-9262 Fax: 905-479-9755 Email: info@kindermann.ca

NEW from the ROM

THE ROM FIELD GUIDE TO

wildflowers of ONTARIO

- Includes more than 500 Ontario species
- Written in clear, accessible language
- Features more than 1000 full-colour wildflower photographs, most of them from the ROM's celebrated collection
- Icons on each page summarize key features, including habitat
- Formatted for quick and accurate species identification
- Fits in a backpack or pocket, with stitched binding for extra strength
- Oil-and-water-repellant cover lamination

$27.99
Available April at bookstores everywhere

RICHARD DICKINSON | DEBORAH METSGER | TIMOTHY DICKINSON

ROM www.rom.on.ca

M&S McClelland & Stewart
The Canadian Publishers
www.mcclelland.com

ate their way through the soft sea floor sediment in which they lived. The excreted mud filled in the burrows behind them. The raised cords look a bit like very long worms. If you look closely at a single burrow you will see regularly spaced markings across the width of the burrow. While these marks appear to mimic the segmentation of a worm, in fact they indicate the rhythmic action of peristalsis in the animal's gut extruding the digested mud.

DAVID RUDKIN, ROM

Close-up of *Arthrophycus alleghaniensis* from the ROM collections, showing the ridges formed by peristalsis.

Over many years, more sediment was deposited on top of the layer in which the worms burrowed and the mud eventually turned to stone. The rock that formed from digested mud was harder than the surrounding sediment, so when the layer was finally exposed, the fossil burrows have resisted the natural weathering and stand out on the bedding surface.

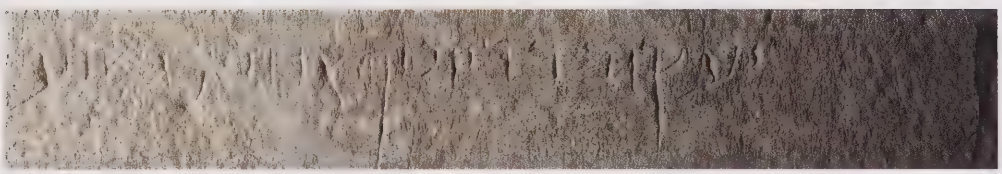
You are not the first person to think that these fossils are plant remains. Their name, *Arthrophycus alleghaniensis*, stems from a similar mistake made by early paleontologists, who thought that these trace fossils were the remains of seaweed. *Phycus* comes from the Latin for "seaweed"; *arthro-* means "jointed." While this is not a particularly rare fossil from the Grimsby area, it is unusual to find such a large slab intact. Thank you for bringing it to our attention.

Janet Waddington is assistant curator in the ROM's Department of Palaeobiology.

History in the Remaking

The specialist who repaired a controversial ossuary that may have links to Jesus aimed to leave few traces of her own handiwork.

For the "James" ossuary exhibit, the ROM used the dating system BCE / CE (Before Common Era / Common Era), a common practice in the academic field of Near Eastern archaeology.



Top: Conservator Ewa Dziadowiec tints her repair work to match the ossuary's limestone. **Bottom:** the inscription: James, son of Joseph, brother of Jesus.

EWA DZIADOWIEC

BRIAN BOYLE, ROM

In Jerusalem, about 100 years before the birth of Jesus, an elaborate Jewish funerary custom began. The dead were placed in tombs, either above ground or in a cave. Once the flesh had decomposed, usually within a year or two, the remains were gathered, and the bones were placed in boxes, or "ossuaries" (from the Latin *ossa*, for "bones"). This efficient practice made room for the next deceased and allowed for convenient storage of remains in family tombs.

Most often, ossuaries uncovered in Jerusalem are from the Second Temple Period, from about 100 BCE to 70 CE, when the Romans destroyed the Temple and exiled the Jews from Jerusalem. Nearly 1000 ossuaries are catalogued in Israel, about a quarter of them inscribed. The name of the deceased would be scratched into the side of the ossuary, and often the father's name as well was added. A brother's name is mentioned on only two known ossuaries. One of these is the "James ossuary" recently displayed at the ROM—the inscription translates as, "Ya'akov (James), son of Yosef (Joseph), brother of Yeshua (Jesus)." In appearance, the James ossuary is a plain limestone box of the type commonly used as a bone box. One side is incised with a circle drawn with a compass, about 15 cm in diameter, inside of which there is a six-pointed star or rosette. On the other is the much discussed and debated inscription.

In an article published in the *Biblical Archaeological Review* Prof. André Lemaire dated the James ossuary to between 50 and 70 CE (coinciding with the death of James, Jesus' brother), thus

establishing what may be the oldest archaeological link to Jesus. Previously, the earliest artifact known to mention Jesus was a papyrus fragment of the Gospel of John dated to about 125 CE. Geological and epigraphic researchers have made two crucial findings that help to authenticate the ossuary: it is indeed made from limestone found in the area surrounding Jerusalem, and the inscription is written in a style typical of the period between 10 and 70 CE.

The ROM was extremely fortunate in obtaining the James ossuary for temporary display from its owner in Tel Aviv. However, on November 1, 2002, when ROM staff removed the packing material, they were horrified to discover that the ossuary had broken into five pieces. To their shock, the ossuary had simply been wrapped in plastic bubble-wrap and packed in a cardboard box. The accepted museum standard involves double wooden crates separated by stiff, impact-absorbing materials.

It was apparent that the ossuary had one large horizontal crack dating from ancient times, which likely deepened as a result of vibration during transport. But the more serious damage, which left it in five loose fragments, was sustained in transit, probably as a result of a strong impact. The Museum offered to repair the artifact by rejoining the pieces and filling the voids where the limestone edges had been crushed. I was greatly honoured to be asked to work on such a significant project. The repair presented a formidable challenge: there were only two weeks before the exhibit opened.

It was not simply a matter of gluing the box back together. Fortunately I had the assistance of colleagues both in the Conservation Department and throughout the ROM: archaeologists, mineralogists, and even a paleontologist helped to examine the ossuary. The patina on its surface provided chemical confirmation of its materials so that the most appropriate adhesives could be used. One aim of my work was to leave as little trace of the conservation work as possible. I joined the cracked pieces of the ossuary using PVA (polyvinyl acetate) resin. What is unusual about this as a treatment for stone is that it is easily reversible—the resin can be removed in the future using acetone. Losses along the cracks were filled with a mixture of PVA, calcium carbonate, and some dry pigments—also entirely reversible. Because it was very important to ensure that the repairs were inconspicuous, earth pigments were added to blend the filler with the colour of the limestone.

Once the ossuary was on display, I was pleased with the results. Working on a project where time was such a critical factor was both very demanding and very rewarding. Ultimately, I hope the restoration work, and the subsequent analysis which would not otherwise have been carried out, will help to solve some of the mystery surrounding the "James" ossuary's provenance.

Ewa Dziadowiec, the ROM's ceramic and stone conservator holds an MA in art conservation.

Masterworks
from the PHILLIPS *collection*

2003.
BUFFALO'S
MOST
BEAUTIFUL
SUMMER.

MAY 27–SEPTEMBER 1, 2003

- Group rates available
- www.albrightknox.org
- Call 1.800.346.2947

ALBRIGHTKNOX
ART GALLERY

INCLUDING WORKS BY:

- CÉZANNE
- VAN GOGH
- DEGAS
- MATISSE
- PICASSO
- RENOIR
- GAUGUIN
- MONET
- EL GRECO
- KLEE
- KANDINSKY
- BRAQUE
- ROUSSEAU
- COROT
- DAUMIER

Pierre-Auguste Renoir (French, 1841-1919). Detail: *Luncheon of the Boating Party*, 1880-81. Oil on canvas, 51 x 68" (129.5 x 172.7 cm). The Phillips Collection. Acquired 1923.
This exhibition is organized by The Phillips Collection, Washington, D.C.
Made possible, in Buffalo, through the generous support of M&T Bank

Tilted Silver

This curious item of 19th-century silverware helped North Americans keep their cool.

Dear ROM Answers,

A number of years ago, while in the United States I purchased a ceramic tankard with hand-painted flowers. The inside is silver and the marking on the bottom reads: SIMPSON HALL MILLER & CO. The rear cup holder is damaged but still attached. I have no idea what the purpose of this object is. My suspicion is that it may have held either hot or cold liquid of some sort. I am curious as to its use and a possible date of production. Can you help?

R. P.,
Montreal, Quebec

Ice-pitcher set in the 1888 catalogue of the Toronto Silver Plate Company.

Dear Reader,

Your piece is known as a tilting ice-water pitcher. The basic form is a tankard-like pitcher suspended on a stand, allowing it to swing easily when grasped by a hand in a pouring motion. Essentially, it is an early form of water cooler, whose purpose was to keep drinking water fresh by slowing the melting process of ice in water. In the late 19th century, before the rise of modern refrigeration, ice-water pitchers were popular. That was the age of the icebox, the iceman, and ice-storage houses, where ice was stored up in the winter for use during the summer months.

In type, your tilting water pitcher is particular to electroplate (silver-plate) and is one of many new forms developed for mechanized production by the silverplate industry. James Stimpson of Baltimore, Maryland, is credited with the invention of the ice-water pitcher. In 1854, it was patented by his son, James H. Stimpson, and licensed to various manufacturers. Following the younger Stimpson's death in 1867, the patent was acquired by the Meriden Britannia Company of Meriden, Connecticut.

The pitcher's distinguishing attribute is the insulation barrier built into its walls. In the earliest pitchers, the barrier consisted of double walls of metal with an air pocket in between. Over the years various improvements were made: treble- and quadruple-walled pitchers were developed, but double-walled pitchers remained the more common form. In 1859, Stimpson patented a new inner wall in which the sheet metal was coated with a porcelain-like enamel. It had the advantage of preventing any residual metallic taste in the water. The added wall thickness made these pitchers rather heavy. A medium-sized ice pitcher could weigh as much as 4.5 kilograms (10 pounds) when empty.

The earliest ice pitchers were free-standing and of relatively plain design. Later pitchers were more exuberantly decorated and after 1869 were often installed in a framework stand. Still later models were outfitted with goblets and a slop bowl in what is called a tilting ice-water set.

How effective were these pitchers? In 1860, Rogers, Smith & Co., of Hartford, Connecticut, published the results of a test under con-

ROSS FOX

ROM Reproductions Shop

One of assorted hand-quilted cotton pillow covers, adapted from Canadiana quilt patterns. 19th Century.

Authentic Reproductions from the ROM's own Collections

Our Canadian Heritage

Royal Ontario Museum
(416) 586-5896
www.rom.on.ca

Regular Price $55.00
Members Price $49.50

Design: Chris Nicholson

Experience our World

- An Arctic Traverse: Hudson Bay to Greenland
- High Arctic Adventure: North Baffin Island
- Turkey: Crossroads of Civilization
- Egypt: A Journey Along the Nile
- Southeast Asia ; Thailand, Laos, Cambodia
- Cuba: Contrasts and Culture
- Morocco and Southern Spain
- Southern Ireland: Stately Homes and Country Gardens
- China: Treasures and Pleasures

See *ROM Members' News* for details.

For further information or a brochure, call:
ROM Travel (416) 586-8034
travel@rom.on.ca

Organized by
The Department of Museum Volunteers
- Royal Ontario Museum -

ROM TRAVEL

trolled conditions. The intent was to compare the rates at which ice would melt in three different kinds of pitchers—a treble-walled pitcher, a double-walled pitcher, and a ceramic (stoneware) pitcher. One-and-a-half pounds of ice were added to each of the three pitchers, which were placed in a room at a temperature of 75° Fahrenheit. The ice took three hours to melt in the ceramic pitcher, six hours in the double-walled pitcher, and ten hours in the treble-walled pitcher.

The finest ice-water pitchers are fitted with an outer porcelain sleeve, decorated with hand-painted ornament. Yours belongs in this category, featuring painted ornament of flowering branches. The three tray-like holders indicate that the pitcher originally had two goblets and a slop bowl, so, in effect, it was an ice-water set.

The maker is Simpson, Hall, Miller & Company of Wallingford, Connecticut, a firm in operation from 1866 until 1898, when it was amalgamated into the International Silver Company. The firm was a major manufacturer of electroplated wares. Your set probably dates from the 1890s. Interestingly, the company also had a Canadian connection. In 1879, Simpson, Hall, Miller & Company established a Canadian subsidiary in Montreal. That same year it had a large display of its wares at the first Dominion Exhibition in Ottawa. By 1896, the company had a plant in Toronto, which came into Canadian ownership within two years. In 1922, the Toronto plant became part of the International Silver Co. of Canada, Ltd.

COURTESY CANADIAN MUSEUM OF CIVILIZATION

Ice-pitcher set by the Standard Silver Company, Limited, is now at the Canadian Museum of Civilization, Hull, Quebec.

Tilting ice-pitchers were popular in Canada, where they were an indispensable article in many dining rooms. On account of their high cost, they often also served as a showpiece. A major Canadian maker was the Toronto Silver Plate Company. Founded in 1882, the company was in operation until 1914 when it was absorbed by a firm called Canadian Wm. A. Rogers Co. Limited. Fourteen different tilting ice-pitchers are illustrated in the 1888 catalogue of the Toronto Silver Plate Company. By comparison, Simpson, Hall, Miller & Company offered nearly 50 designs. Another Toronto-based maker of ice-pitchers was the Standard Silver Company, Limited. After 1900 the ice-water pitcher slipped from fashion in Canada. The electric refrigerator, introduced in 1911, eventually sealed its fate.

For further information on ice-water pitchers, see:

- Edmund P. Hogan, *The Elegance of Old Silverplate and some Personalities* (Exton, PA: Schiffer Publishing Ltd., 1980), pp. 34–41.
- Dorothy T. Rainwater and H. Ivan Rainwater, *American Silverplate* (West Chester, PA: Schiffer Publishing Ltd., 1988), pp. 248–263.

Dr. Ross Fox specializes in Canadian decorative arts in the ROM's Department of Western Art and Culture.

WE'D LIKE TO HEAR FROM YOU

If you own furniture, silver, glass, metalwork, ceramics, textiles, or small decorative objects that may have an interesting past and have aroused your curiosity, this column is for you. Send a clear colour photograph (or 35-mm colour slide) of the object against a simple background, providing dimensions, a description, any markings, or any known details of its history to: ROM Answers, c/o *Rotunda* magazine, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6. Be sure to enclose a stamped, self-addressed envelope large enough to include any photos that must be returned to you.

Neither *Rotunda* nor the author nor any other person who may be consulted assumes any legal responsibility for these opinions or their ramifications. No financial appraisals will be offered.

Letters will be acknowledged as staff time permits.

TRAVELLING SHOW AND TELL

ROM's Outreach Program has long brought the Museum to Ontario classrooms

ROM ARCHIVES

PLANTAGANET HIGH SCHOOL Social Studies teacher T. J. Campbell, holds this class of Franco-Ontarian students in thrall with an Australian boomerang and other ROM treasures from a port-a-museum school case. The students were able to see, handle, and examine Museum objects first-hand. (The photograph visible in the top of the case shows the same 14th-century bed and oak panelling that is currently on display in the Samuel European Galleries.)

The Museum has a long history of ensuring that its artifacts and specimens are made available to schools in rural communities. In the 1930s entire railway cars were commissioned to bring students to Toronto. But by February 24, 1950, when this photo was snapped, the artifacts were travelling to students in far-flung regions of the province such as this small village in the Ottawa Valley. The school-case program has remained a vital component of the ROM's Outreach programming ever since. School cases and the smaller resource boxes are regularly updated to keep pace with Ontario's changing school curriculum. To browse current offerings on the Web, go to www.rom.on.ca/outreach.

JULIA MATTHEWS

Julia Matthews is head of the ROM's Library and Archives.

If a ROM teacher or school kit came to your school, send us your reminiscences at info@rom.on.ca.

Life Management Solutions™

Assante

Making Life Simple

We are living in a rapidly changing world. It's a world filled with more choices, more complexity and less time to do it all. How can you find the time to make sure your affairs are looked after yet still focus on our own interests?

One Trusted Advisor

Assante Global Advisors (Canada) are among the most respected and highly accredited in the country.

Assante provides you with access to a wealth of investment and financial planning resources backed by a team of specialists including:

- portfolio management experts
- estate and retirement specialists
- tax lawyers
- accountants

Assante can help organize and simplify your financial life so that your time remains free to focus on life's other issues.

For investors with portfolios in excess of $1,000,000, contact:

Robert Pierce, R.F.P.
Senior Vice President
Assante Global Advisors (Canada)
2950 - 130 King Street West
Toronto, Ontario M5X 1A9
rpierce@assante.com

Ph: 416 304-6614 • Fx: 416 307-3325 • Toll-free: 1 888 248-9472

CADILLAC ESCALADE
BREAK THROUGH
gmcanada.com
THE MOST POWERFUL SUV IN THE WORLD.